SCIENCE

FRIDAY, JANUARY 30, 1914.

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THE DOCTOR'S DREAM[1]

DR. SMITH is a practitioner in one of the large cities of the middle West. He is a man of good training, a classical graduate, took his professional course in one of our best schools, and did hospital service both at home and abroad. He is a general practitioner and keeps well posted in all that he does. He makes no claim to universal knowledge or skill, but is conscientious in all his work, and when he meets with a case needing the service of a specialist he does not hesitate to call in the best help. He has made a good living, demands fair fees from those who are able to pay, and gives much gratuitous service to the poor. He is beloved by his patients, held in high esteem by his confreres, and respected by all who know him. He is a keen observer, reads character for the most part correctly, and is not easily imposed upon. While he recognizes the value of his services, he is not in the practise of medicine with the expectation of getting rich, and his interests are largely humane and scientific. He has deep sympathy for those whose ignorance leads them to sin against their own bodies, but he is devoid of weak sentimentality and does not hesitate to admonish and even denounce the misdeeds of his patients whatever their social position. During twenty years of practise in the same locality he has become acquainted with the vices and virtues of many families. He is not looking for the coming of the millenium, but he is often impatient of the slow pace with which the race moves

[1] Read at the seventh annual meeting of the Association of Presidents of Life Insurance Companies, December 11, 1913.

towards physical, mental and moral betterment. One of his patients is a large manufacturer employing many unskilled laborers. Dr. Smith has often pointed out to this man that the efficiency of his working force would be multiplied many times were the men paid better wages, the work done in rooms better lighted and ventilated, and in general with a little more humaneness shown them. Another is at the head of a large mercantile house which employs clerks at the lowest possible wages and makes the conditions of life well nigh unendurable. A wealthy woman gives largely to church and charity from her revenues which come from the rental of houses in the red light district. Another of the doctor's patrons is a grocer who sells "egg substitutes" and similar products "all guaranteed under the pure food law." We will not continue the list of the doctor's patrons and it must not be inferred that all are bad, for this is not true. The majority are honest, conscientious people, as is the case in all communities. Our country has a population of nearly one hundred millions. Millions of these are decent, respectable citizens, not altogether wise, but for the most part well intentioned. Thousands are brutal in their instincts, criminal in their pursuits, and breeders of their kind. We claim to be civilized, but there are those among us who would be stoned to death were they to attempt to live in a tribe of savages. But I must stop these parenthetical excursions and get back to Dr. Smith and his dream. On a certain day in November of the present year he had been unusually busy, even for one whose working hours frequently double the legal limit. During his office hours he had seen several cases which gave him grave concern. There was William Thompson, the son of his old classmate and college chum, now Judge Thompson. William finished at the old university and is now an embryo lawyer promising to follow in the footsteps of his honored and honorable father, but William belonged to a fast fraternity at college and came to Dr. Smith this morning with copper-colored spots over his body and a local sore. The doctor easily diagnosed the case and pointed out to William that he was a walking culture flask of spirochetes, a constant source of danger to all who should come in contact with him, and that years of treatment would be necessary to render him sound again. On the lip of a girl, the daughter of another old friend, the doctor had found a chancre caused by a kiss from her fiancé, a supposedly upright man prominent in church and social circles. He had seen a case of gonorrhea in a girl baby contracted from her mother, the wife of a laboring man. A case of gonorrheal ophthalmia in a young man whose only sin was that he had used the same towel used by an older brother next demanded his attention. Several cases of advanced tuberculosis among those who had been told by less conscientious physicians that the cough was only a bronchial trouble made Dr. Smith lament the standard of skill and honor among some of his professional brethren. Rapid loss in weight in an old friend who had been too busy to consult him earlier was diagnosed as neglected diabetes. In another instance dimness of vision and frequent headaches persisting for months had not sufficed to send an active business man to the physician. This proved to be an advanced case of Bright's disease, which should have been recognized two years earlier. Urinary, ophthalmoscopic and blood pressure tests demonstrated the seriousness of the present condition. A breast tumor on the wife of an old and respected friend showed extensive involvement of the axillary glands and the operation demanded promised only temporary relief, while

had it been done months before, complete removal of the diseased tissue would have resulted. In making his calls for the day Dr. Smith had experienced both among the well-to-do and the poor many things which had brought within the range of his vision more and darker clouds than those which floated in the dull November sky. More than a year before he had become estranged from the family of one of his oldest and best friends. The breaking of this relationship which had continued from his earliest professional service and had been filled with the common joys and sorrows shared only by the family physician and those under his charge, had cast a deep shadow over the doctor's life. He had officiated at the birth of each of his friend's five children, and he felt a parental love and pride in them as he saw them grow into healthy womanhood and manhood. A little more than a year ago, he learned that the eldest of these children, a beautiful and healthy girl of eighteen, was engaged to a young man whom he knew to be a rake. In a spirit of altruism he had gone to the father and mother and protested against the sacrifice of the daughter. This kindly intended intervention was met with a stormy rebuff, and the doctor was rudely dismissed from his friend's house. But when the young woman whose life with her unfaithful husband had made her deeply regret her fatal infatuation, felt the first pains of childbirth she begged of her parents that her old friend might be sent for, and that morning he had delivered her of a syphilitic child. How unlike the previous births at which he had officiated in this friend's house! It had been the custom to have the doctor at every birthday dinner given the five children, and one of the boys bore his name. There would be no birthdays for this, the first grandchild, and what could the future promise the young mother? Surely, the November day was overcast with clouds for Dr. Smith before its gray light awoke the slumbering city. As he walked the few short blocks from his friend's to his own home, he cried in deepest sorrow how many thousands of daughters must be sacrificed before their parents will permit them to walk in the light of knowledge and not in the shadow of ignorance. After a breakfast, which was scarcely tasted, he read in the morning paper that the announcement that "Damaged Goods" was to be given in his University town had met with such a storm of protest from the learned members of the faculty that the engagement had been cancelled. "Surely," he said, "the fetters of prudery and custom bind both the learned and the unlearned."

After his morning office hours Dr. Smith visited his patients at the city hospital. Here is a wreck from cocaine intoxication, the poison having been purchased from a drug-store owned by a prominent local politician. In a padded cell is a man with delirium tremens, a patron of a gilded saloon run by another political boss. In the lying-in ward are a dozen girls seduced in as many dance halls with drinking alcoves. Time will relieve these girls of the products of conception, a longer time will be required to free them from the diseases which they have contracted, but all time will not wash away the stains on their lives, and what of the fatherless children to be born? Thirty beds are filled with typhoids, who under the best conditions must spend long weeks in the bondage of a fever, which day by day gradually but inexorably tightens its grasp. The furred tongues, glazed eyes, flushed cheeks, bounding pulses, emaciated frames, delirious brains were all due to the fact that a large manufacturer had run a private sewer into the river above the water works. The greed and ignorance of one business firm had

been permitted to endanger the lives of half a million of people. In his family calls the doctor met with conditions equally lamentable. A fond mother in her ignorance had nursed a sore throat in one of her children with domestic remedies. The membranous patches on the tonsils, extending upward into the nasal passages and downward into the larynx, and the cyanotic face with labored breathing showed that even the magical curative action of diphtheria antitoxin, that wonderful discovery of modern medicine, would be of little avail in this individual case. The other children were treated with immunizing doses and the doctor had the consolation of knowing that death's harvest in that household would be limited to the one whom the mother's ignorance had doomed.

The next call brought Dr. Smith to a home in which the conditions were equally deplorable and still more inexcusable. One of the children some months before had been bitten by a strange cur which soon disappeared in the alley. The wound was only a scratch and was soon forgotten. Now, the child was showing the first symptoms of that horrible disease hydrophobia. But dogs must not be muzzled. Women with plumes, torn from living birds, in their hats, formed a society for the prevention of cruelty to animals, and so declared.

It must not be inferred that all of Dr. Smith's experiences on that November day were sad. Men are mortal; all sickness is not preventable, accidents will happen and distressing injuries result. This world is not an Eden and no one expects that all sorrow will be banished from it. Decay and death approach with advancing years. Strength and weakness are relative terms and those possessed of the former must help bear the burdens of those afflicted with the latter. Dr. Smith being a hard-headed, reasonable, scientific man, is no Utopian, and he frequently meets in sick rooms experiences which greatly increase both his interest and his confidence in man. He finds the young and vigorous denying themselves many pleasures in order to brighten the pathways of the old and infirm, the fortunate lending a helping hand to the unfortunate, and the wise leading the unwise. No one, more than the family physician, can measure and appreciate the innate goodness that springs without an effort from the heart of humanity. It is difficult for the physician of large experience to unreservedly condemn any one, and he is inclined to regard all sins as due to either heredity or environment. However, it must be admitted that on this day Dr. Smith had seen but little sunshine and the clouds that had gathered about him had hidden the virtues and magnified the vices of his community, and especially was this true of the vice of ignorance, for ignorance which results in injury to one's fellows is not only a vice but a crime, a moral, if not a statutory one.

Late that night as the doctor sat before his grate he fell asleep, and now he is busy among his patients in a way hitherto quite unknown to him. His waiting-room is filled with people, old and young, of both sexes, who have come to be examined in order to ascertain the exact condition of their health. A young man before proposing marriage to the woman of his choice wishes a thorough examination. He wishes to know that in offering himself he is not bringing to the woman any harm. He desires to become the father of healthy children and he is not willing to transmit any serious defect to them. He tells the doctor to examine him as carefully as he would were he applying for a large life insurance. The doctor goes through the most thorough physical examination and tests the secretions and blood with the utmost care. He

understands his own responsibility in the matter and appreciates the high sense of honor displayed by his patient. A young woman for like reasons has delayed her final answer to the man who has asked her hand in order that the doctor might pass upon her case. Here is the doctor's old friend, William Stone. Mr. Stone is in the early fifties. He has been a highly successful, honorable business man, has accumulated a sufficiency and enjoys the good things which his wife prepares for the table. A careful examination of the urine leads the doctor to caution Mr. Stone to reduce the carbohydrates in his food. Mr. Perkins, a lawyer who throws his whole strength in every case he tries, and of late has found himself easily irritated, shows increased urinary secretion and a blood pressure rather high. A vacation with light exercise and more rest is the preventive prescription which he receives. Mrs. Williams, after being examined by Dr. Smith, undergoes a slight operation under local anesthesia, and is relieved of the first and only malignant cells found in her breast. Richard Roe, who is preparing for a long journey, is vaccinated against typhoid fever, a disease no longer existent in Dr. Smith's city since pollution of the water has been discontinued. John Doe, who is a mineralogical expert and wishes to do some prospecting in high altitudes, has his heart examined. There are numerous applicants for pulmonary examination. This is done by Dr. Smith and his assistants in a most thorough and up-to-date manner, and advice is given each according to the findings. It has been many years since Dr. Smith has seen an advanced case of pulmonary tuberculosis and the great white plague will soon be a thing of the past. Every body goes to a physician twice a year and undergoes a thorough examination. The result of this examination is stated in a permanent record and no two consecutive examinations are made by the same physician, in order that a condition overlooked by one may be detected by another. Cases of doubt or in which there is difference of opinion are referred to special boards. The average of human life has been greatly increased and the sum of human suffering has been greatly decreased. Preventive has largely replaced curative medicine. Tenements are no longer known; prostitution and, with it, the venereal diseases have disappeared; institutions for the feeble-minded are no longer needed, because the breed has died out; insanity is rapidly decreasing because its chief progenitors, alcoholism and syphilis, have been suppressed. These and many other pleasing visions come to Dr. Smith in his dream, from which he is startled by the ring of the telephone at his elbow. The call says: "Come quickly to Pat Ryan's saloon at the corner of Myrtle and Second. There has been a drunken row. Bring your surgical instruments." Then the smiles which had played over the face of the doctor in his dream were displaced by lines of care and he went forth into the darkness of ignorance and crime.

There are many Dr. Smiths and they have been seeing pleasing visions in their dreams and meeting with stern realities in their waking hours. Nearly fifty thousand Dr. Smiths constitute the American Medical Association which is expending thousands of dollars annually in trying to so educate the people that unnecessary disease will be prevented. The doctors are asking that the work of the national, state, municipal and rural health organizations may be made more effective, that the knowledge gained in the study of the causation of disease may be utilized. The world has seen what has been done in Havana and on the Canal Zone, how yellow fever and malaria

have been suppressed, and how the most pestilential spots on earth may be converted into healthful habitations for man. Scientific medicine has made these demonstrations and the world applauds, but seems slow to make general application of the rules of hygiene.

Dr. Foster had experienced the doctor's dream when he said to you in 1909:

> I look forward with confidence to the time when preventable diseases will be prevented, and when curable diseases will be recognized in the curable stage and will be cured, and I believe the grandest triumphs of civilization will be the achievements which will result from a realization of the possibilities of preventive medicine.

Professor Fischer, a most earnest and intelligent student of the prevention of sickness and the deferring of death has stated that "by the intelligent application of our present knowledge, the average span of human life may be increased full fifteen years."

It has been proposed that the life insurance companies represented here seek to prolong the lives of their policyholders by offering them free medical reexamination at stated intervals. It has been shown that in all probability this would financially benefit the companies in the increased longevity of their policyholders and the increased number of premiums they would pay. This is a business proposition, and I hope that the companies will inaugurate it and thus demonstrate that the lessening of sickness and the deferring of death will pay. Let the insurance men join the doctors and help in the great work for the uplift of the race through the eradication of unnecessary disease and premature death. In this way we can hasten the coming of the better man by making the doctor's dream a reality. I am confident that you will do this, not because it will pay, but because it is the highest service you can render humanity.

Victor C. Vaughan
University of Michigan

The American Association for the Advancement of Science

Science, Education and Democracy[1]

Science, education and democracy—the three great enterprises of the modern world—are in no institution more completely represented than in this American Association for the Advancement of Science and in its section of education. We are organized to advance science in all its range from the most esoteric deduction of the mathematician to the most homely contrivance of the inventor, and at the same time to diffuse scientific knowledge and scientific method among all who are willing to listen. Our membership includes the ablest scientific leaders and equally those who in Bishop Berkeley's phrase are "undebauched by learning." We migrate from place to place for our meetings in order that we may teach and learn in all parts of the country. We form more nearly a democracy of science than any other organization. Education is amalgamated with every section of our association, which is as completely an educational institution as is a university. And as the university, devoted throughout to education, yet may include a department or school of education, so we have conducted in recent years a section of education. This section is concerned with the place of the sciences in our educational system and with improving the methods of teaching them. It has also as its object, perhaps its principal object, the development of a science of education; for there is no other applied science—not agri-

[1] Address of the vice-president and chairman of the Section of Education of the American Association for the Advancement of Science, read at Atlanta, Ga., on December 31, 1913.

culture, nor engineering, nor medicine—of equal importance. It is also true that none is more backward and empiric, none in greater need of scientific principles and scientific methods.

The adequacy of much of our mathematical teaching is illustrated by the high-school boy's answer to the question "What follows when the three sides of a triangle are equal?", this being "The other side will be equal too." However that may be, science, education and democracy are the essential sides of the triangular base on which rests the pyramid of the civilization that we have, on which will stand even more solidly the better civilization that is to be. The foundations we can follow downward as far as we may fancy—to prehistoric and prehuman times, to metazoa and protozoa which learn by experience and have a certain equality of opportunity. In the long course of evolution, science and education always have been interrelated. Accumulated and transmitted knowledge has been the basis of education, and in turn education has made possible the accumulation and transmission of knowledge. Thus have come language and writing, the alphabet and printing, tools and machines, fire and shelter and clothing, the cultivation of plants and animals, fine arts and religions, sciences and their applications, codes of conduct and methods to enforce them.

During the historic period there has been a conflict between science and education, on the one side, and democracy, on the other. Among the lower animals and to a certain extent in savage tribes, there exists a kind of democracy and equality of opportunity. Each individual faces the world with the endowment received at birth, not greatly helped by the position of his family or his group. But when knowledge and education became so complicated that they could not be shared equally by all, when wants increased to the extent that some had to be deprived in order that others might be gratified, when there was competition for property and wealth, then society was thrown into a patriarchal or feudal or despotic or oligarchic system. The material resources did not suffice to provide adequately for all; the stronger seized on them, and the many were compelled to toil in ignorance and poverty in order that the few might enjoy knowledge, leisure and luxury. Unto those who had was given and from those who had not was taken even that which they had. The system of individual, family, class, race and sex privilege gained the saddle and still rides us all.

The dominance of privilege was perhaps a necessary stage in social development. It may be that power and wealth concentrated in individuals, citizens and slaves, an aristocracy exploiting serfs, dependent women, subject races, were required to save the primitive state from submergence under savagery and barbarism, to develop its institutions, to promote science and the arts, to set standards of conduct. Plato provided slaves for his republic; the New Testament accepted Cæsar, slavery and the subjugation of women. When the resources of society were sufficient to provide adequately for only a part of its members, universal education and equality of opportunity could not exist. The masses were compelled to work incessantly for the bare necessities of life, in order that there might be classes in a position to advance science and the arts. When the average age at death was twenty years, the race could only be continued if women spent their lives in bearing, rearing and burying their children.

But science with its applications has recreated the world. Within a century, or at most two centuries, it has quadrupled the efficiency of labor and doubled the length of life. Steam and electricity enable one

man to do what formerly required a hundred. A needle or a lucifer match is worth a thousand times what it costs. The mail which I send and receive daily at an expense of two or three dollars would cost hundreds of thousands of dollars if each piece were delivered separately without modern methods of transportation. It would take all the time of all the people in the United States to write part of what they now print. In the western world famine is no longer a factor. Cholera, smallpox and the plague have decreased their toll to less than one per cent. of what they once claimed. Infant mortality has been reduced from forty to ten in a hundred. The average life of a woman after the birth of her last child is perhaps three times what it was.

The economy of labor and of life which the applications of science have wrought has abolished the need of productive toil by children and has made possible their universal education. The wealth of society is now sufficient to support adequately every child, to give it the education that opens the gateway to the career for which it is fit, to provide equality of opportunity and a true social democracy. At the same time this education, which can be continued through life, for not more than four hours a day of routine labor by each adult would suffice to provide its necessities, gives the basis for a stable and complete political democracy. The exploitation of children, sex slavery, industrial servitude, kleptocratic classes, have become wanton and intolerable. It is also true that in addition to its economic control, science has been a dominant factor in education and in life. It not only makes the education of all possible, but its subject matter and especially its methods supply the best material for education. It gives us leisure and at the same time means to use leisure worthily. It has lessened ignorance, superstition and unreason; it has taught us to tell the truth as we see it, and in increasing measure to see the truth as it is.

Material science has provided the economic foundations of democracy. I believe that the science of conduct justifies democracy and will guide its laws and institutions. But this, it must be acknowledged, is only a matter of opinion. One of my college friends has become perhaps the most distinguished mathematical physicist of the world. Standing for parliament recently, the four principal theses of his electoral address were: Maintenance of a hereditary house of lords, introduction of a protective tariff, the denial of home rule to Ireland, state schools under the church. These reactionary policies were endorsed by his election to represent one of the great English universities. So little do intelligence, character and scientific attainment lead to agreement in regard to social and political theories. Each of us is enmeshed in the net of his class, and has but little freedom of movement. The individual does not as a rule act in the light of reason, but by instinct and impulse, and it is well that he does, for they are the safer guides. But while individual conduct is in the main automatic response to chance circumstance, it is possible by forethought to select individuals and to arrange circumstances. Education and scientific research are subject to social control and should be the chief concern of a democratic society.

American democracy has been on the whole favorable to common-school education. It is admitted that our masters must be taught, and in practise this country has led in public elementary education and now leads in the provision of high-school and college education. More than 96 per cent. of all children from ten to fourteen years of age are enrolled in school. There are

one million two hundred thousand students in high schools; a third of a million in higher institutions. Reading and writing have become, like air and water, the common heritage of all. This is the great achievement of democracy in the modern world. Thereby it has assured its own permanence and has opened up the way along which it will advance.

Reading and writing are indeed only pass-keys which unlock various gates. Further progress by way of the newspaper and the moving-picture show is halting. We have inherited the educational ideals of the idling classes and their dependent priests and clerks. The common school prepares for the high school, the high school for the college, the college for "Who's Who." Our scholastic methods, invaluable for intercommunication at a distance in space and time, may inhibit thought and action, even the finer forms of speech and the more direct expression of the emotions. A few days since a neighbor in the country, now over eighty years old, who suffered or enjoyed such educational limitations that she can barely read, wrote to me "I am still alive but i don't know what for." At school she would have been taught to use modestly a capital "I" for the first personal pronoun and not to end a sentence with a preposition. I have learned these things and to use words such as "direct" and "effective," but I do not use words so directly and effectively as my neighbor. One of my children at the age of ten, never having been in school, wrote verses such as:

> An army marching through the fields
> They had on their shields
> They were ready to fight until night
> But there was no army to fight

and

> The breeze that blows is the salt sea breeze

After instruction in English she relapsed into the conventional and the commonplace.

Who now can write a sentence such as "In the beginning God created the heaven and the earth," or sentences such as are found on every page of Homer and Dante? In the words of Arnold:

> What girl
> Now reads in her bosom as clear
> As Rebekah read, when she sate
> At eve by the palm-shaded well?
> Who guards in her breast
> As deep, as pellucid a spring
> Of feeling, as tranquil, as sure?
>
> What bard,
> At the height of his vision, can deem
> Of God, of the world, of the soul,
> With a plainness as near,
> As flashing as Moses felt
> When he lay in the night by his flock
> On the starlit Arabian waste?
> Can rise and obey
> The beck of the Spirit like him?

We do not know what well-educated men and women who could not read would be like. If the authors of the Homeric poems could read and write they did not spend much time in such occupations. Certainly they did not learn to use their own language by the study of Latin. A friend asked a porter in a Swiss hotel, who used many languages with equal facility and incorrectness, which was his native tongue. He replied that he did not know, he spoke all languages; then, in answer to the question as to the language in which he thought, "I neva tink."

Children must learn to read, write and calculate, but under proper conditions of family and society schools to teach these tricks would be nearly as superfluous as schools to teach infants to walk and talk. Those familiar with the literature of pedagogic edification will be weary of the iteration that the word "educate" means to lead out, which, not cramming full, should

be the object of our schools. This is not only trite, but also true. Every psychologist knows that perceptions are not there to be perceived, but as a condition of reactions; that we learn by doing; that conduct is the only thing that counts. But it is also true that by its etymology the word "educate" might mean to lead out the individual for the work for which he is fit, to select the "dukes," the leaders, for a democracy. This is the greatest service of education. We learn to do things not by preparing to do them, but by doing them; we get a wider outlook not by so-called cultural studies, but by association with those who have broad and unselfish interests; we must learn what others know, but it is more important to do what we have not been taught and what others have not done. The chief object of the school is to open for each child the gateway to the career for which he is fit. Democracy does not mean equal mediocrity of all, but performance by each in accordance with his ability.

What a man can do is prescribed at birth; what he does depends on opportunity. The famous clause "all men are created equal" was probably intended by Jefferson to mean equal in respect to life, liberty and the pursuit of happiness. However that may be, the doctrine of evolution by natural selection has taught every one that the individuals of a species are unlike at birth. The amount of congenital unlikeness in men and the extent to which it is inherited in successive generations, on the one hand, and the degree to which men can be fitted by education and experience for different performances, on the other hand, are scientific problems on the solution of which depends the future of social and political institutions. If superior ability occurs only or chiefly in certain family lines, if classes, races and the sexes are not only different but subordinated one to the other by the barriers of an impassable heredity, then an aristocratic society and an oligarchic government are imposed by nature. If each finds of necessity his level and his place by native endowment, then universal education and equality of opportunity are of small significance. If, on the contrary, among five children taken at random from the public schools, one is likely to surpass in ability and character the privileged boy at Groton or St. Paul's; if nine boys out of ten and ten girls out of ten have no chance to show what they are fit to do, then our need is more democracy and better opportunity for the fit.

I have found that of our thousand leading men of science, 134 were born in Massachusetts, 3 in Georgia. For each million of their population, Massachusetts and Connecticut have produced a hundred scientific men of high standing; the states of the southern seaboard but two. Does this disparity measure difference of natural ability or difference of opportunity? The frailties of human nature are responsible for two experiments which, if not executed with scientific precision, have been conducted on a large scale. In this country and in Great Britain, four per cent. of children are illegitimate; in continental cities the percentage is as large as twenty and even forty. It is probable that these children have a physical heredity equal to that of the average child, but their social heritage is inferior, and their performance corresponds with their opportunity. If heredity were predominant there should be among our thousand leading men of science some forty of illegitimate parentage, whereas there are few or none. The mulattoes are by their physical heredity midway between the whites and the negroes, with parentage probably superior to the average in both races. But their social position is that of the negroes, and their per-

formance corresponds with their environment rather than with their heredity. There is not a single mulatto who has done creditable scientific work.

According to unpublished statistics which I have collected, 43 per cent. of our scientific men come from the professional classes who form one thirtieth of the population. Probably one half of them are sons of the one per cent. of the population most favorably situated to produce them. A child must be well born if he is to become a large figure in the world, but there may be tens of thousands of children born with the natural endowments of our productive scientific men who are given no opportunity to develop and use their ability for the benefit of society. A child with the exact constitution of Darwin born in China a hundred years ago would surely not have become Darwin. What chance would he have had in this country, or even in England, if his father had not been a man of wealth? The chief object of our educational system should be to select men and women for the work for which they are most fit. To train them for it is also important, but less so. In England one half of its men of performance have been educated at two universities having together some 6,000 students, nearly all from the dominant classes; one half of its cabinet ministers have come from a few interrelated noble families. It may be that there the object of the universities has been to train the privileged classes, of the trade schools to train artisans. Here the end of our schools is to break down, not preserve, the barriers of birth, to provide opportunity, not privilege.

Our democracy has not failed in its quantitative provision of education, but it has been backward in adjusting this education to its needs. In the elementary school, in the high school, in the conventional college, to a certain extent in the university with its professional schools, outworn traditions have persisted. The high school and college are in large measure traditional female seminaries of the kind that used to teach "Latin, logic and the use of globes." The colleges of liberal arts when women are excluded tend to unite the amusements and amenities of a county club with the frivolous amateurism and the futile scholasticism of its class-rooms. The schools of medicine and of law have been until recently trade schools of poor grade, proprietary institutions largely conducted for the indirect financial profit of the professors. Endowments are now being provided and standards are being raised, but there is something amiss in a system which does not permit a man to become self-supporting or to engage in his life's work until he is twenty-seven years old. If the cost of a physician's education must be $10,000, this money should be paid for those most competent to profit from it, not for those only whose parents happen to have so much money.

Nothing could be more undemocratic and anti-social than the plan of endowing—namely, compelling the people to support without the power to control—institutions where the sons of the newly rich may acquire the manners and prejudices of the leisure classes, and at the same time to conduct trade schools in order that there may be cheap skilled labor for exploitation. But the road to democracy may be paved with bad intentions. It is one of the ironies of history that the university endowed by wealthy and pious patrons for the education of the clergy and the upper classes, intended for the support of church and state, should by the nature of knowledge subvert the old orthodoxy and the old social and political system. It is safe to predict

that the trade school will do its share to break down the capitalistic regime.

In the charmingly worded address given by the then professor of jurisprudence and politics at the sesquicentennial exercises of Princeton University, the orator said:

> I am much mistaken if the scientific spirit of the age is not doing us a great disservice, working in us a certain great degeneracy. Science has bred in us a spirit of experiment and a contempt for the past. It has made us credulous of quick improvement, hopeful of discovering panaceas, confident of success in every new thing. . . . I should fear nothing better than utter destruction from a revolution conceived and led in the scientific spirit. . . . Can any one wonder, then, that I ask for the old drill, the memory of times gone by, the old schooling in precedent and tradition, the old keeping of faith with the past, as a preparation for leadership in days of social change? . . . I have had sight of the perfect place of learning in my thought . . . calm Science seated there, recluse, ascetic, like a nun, not knowing that the world passes, not caring, if the truth but come in answer to her prayer; and Literature, walking within her open doors, in quiet chambers with men of olden time, storied walls about her, and calm views infinitely sweet; here "magic casements, opening on the foam of perilous seas, in fairy lands forlorn," to which you may withdraw and use your youth for pleasure; . . . its air pure and wholesome with a breath of faith; every eye within it bright in the clear day and quick to look toward heaven for the confirmation of its hope.

Fourteen years later the same speaker, with his ear to the ground, heard better voices:

> The great voice of America does not come from seats of learning. It comes in a murmur from the hills and woods and the farms and factories and the mills, rolling on and gaining volume until it comes to us from the homes of common men. Do these murmurs echo in the corridors of universities? I have not heard them. (Speech to Pittsburgh alumni, April 17, 1910.)

It is he who listened to the voice of democracy who has been chosen to be its leader.

While it is proper to protest against the undemocratic survivals in the universities which we have inherited, the great services which they have rendered and now perform should not be forgotten. From the foundation of the universities of Salerno, Bologna, Paris and Oxford to the establishment of the Johns Hopkins, Stanford and Chicago, the university has been one of the principal factors in the advancement of science and in the progress of civilization. Three fourths of our productive men of science are now supported by universities. It is under the ægis of privilege and patronage that we have passed into the dawn of democracy. Our state universities are now assuming leadership, and should be counted with the public schools of which they are the head as our greatest contribution to educational progress and social welfare. The state university, directly responsive to the utilitarian democracy on which it depends, open to men and women on equal terms, selecting from all the people of the state those most fit for higher education and preparing them directly for their work in life, devoted in equal measure to teaching, research and public service, holds high the standard under which we move forward into the newer world.

There is a critical point in intelligence at which it is understood that education and productive science are the investments that pay the highest interest. This nation, thanks to the advances of science and to its natural resources, has the means to educate every child in the manner and to the extent that is desirable for the individual and for society. It has the wealth to make investments in scientific research to the extent that men can be found to carry on the work. The framers of the new income tax estimate that the superfluous personal incomes amount to over eight billion dollars annually, that is, the incomes which some 400,000 families possess beyond $4,000

a year. This would allow four billion dollars a year for scientific research and the conservation of health and $200 for each child beyond what is now spent on it. And why should not the money be so used? It would be the investment yielding the largest dividends. Those who spend $4,000 a year already consume four times the average amount. Some may contribute more than four times the average amount to society, but they do so owing to the opportunity and advantage which society has given them. Thanks to the social order, those spending $4,000 a year consume at least ten times as much as was possible for the average man a hundred years ago, and this possibility is due chiefly to the services of men now dead, most of all to those who advanced science and its useful applications. We can best reward them and honor their memory by using the wealth which they have created for further progress in the direction in which they led.

How long will it take to learn that the privileges of property are subordinate to the welfare of children? The average salary paid to teachers in the public schools of North Carolina is $199, of Pennsylvania $440, of California $817. The state of Pennsylvania spends on its entire educational system less than one tenth of the value of the coal it mines. When a state consumes its natural resources it should reinvest their entire value in education, scientific research and the public welfare. In 1880 forty per cent. of the teachers in our public schools were men; now the percentage is under twenty; in New England and in New York it is under ten. In Germany four fifths of the teachers are men. Why should ignorant and characterless girls be permitted to practise education on our children because they are cheap? If the salaries of teachers were doubled, some competent men would adopt the profession for a life work, and the best women could be selected, preferably those who had first cared for children of their own. The applications of science in the conservation of life and the production of wealth have entirely altered the position of women and of the family. In elementary schools the best teacher is the family—husband, wife and children together.

It is for the honor and ultimate welfare of Georgia that 25 per cent. of its population are children of school age, whereas only 17 per cent. of the population of New York and New England—probably less than 12 per cent. of their native population—are of this age. Since 1880 Georgia has increased its per-capita payment for public-school education sixfold; New York and New England have only doubled theirs. In the past twenty years New York and New England have not increased their expenditure enough to make up for the depreciation in the value of money. Georgia spends each year 6.3 mills on the assessed valuation of its real and personal property on public-school education, New York state 4.7 mills.[2] The south is bent under the inherited burden of slavery and civil war. But if it maintains its birth rate and cares properly for its children and its health, the center of wealth and civilization will return southward.

Over a billion dollars a year are spent in the United States on the drinking of alcohol and its consequences, a comparable amount on prostitution and its ensuing diseases. We devote twice as much money to each of these destructive agencies as to our entire educational work. Pleasure auto-

[2] Real estate is underassessed in Georgia. In New York personal property is scandalously understated, owing to the tax. Personal property in Massachusetts is valued at more than two thirds of the real estate, in New York at less than one twentieth.

mobiles or moving-picture shows cost each year more than the support of the teachers in all our schools. The national wealth is ample to double the salary of every teacher, from the negress in Georgia who receives $100 a year to the professor at Harvard who receives $5,000. The qualifications of the teacher should be as much above those of the lawyer and physician as they are now below them. The dentist who mends my children's teeth earns over $20,000 a year; the professors and instructors who teach them at the university receive salaries averaging about $2,000. Teaching can not be made the most honorable of professions by increasing salaries, but this is the easiest way to raise its standards. If we can bring into the work men of ability, they will promote the reforms that are needed. Teachers have inherited the status of domestic servants, and like domestic servants they should free themselves from personal subjugation. It may be that a hundred years hence the English suffragettes and the leaders of the I. W. W. will be counted among the world's reformers. But we can scarcely imagine that it will ever be looked back on as creditable that the salary and even the chair of a university professor should be dependent on the favor of a superior official, or that the educational authorities of our largest city should forbid the employment of married women as teachers; should permit a woman teacher to marry, but should discharge her if she bears a child.

Both the difficulties of state and endowed education and the possibilities of education in a democracy are exhibited by the performance of institutions such as the Scranton International School of Correspondence and Valparaiso University, which by the initiative of single individuals can compete successfully with all the resources of state support and private philanthropy. It is a triumph of democracy that such institutions are possible; it is a scandal of democracy that they exist. The same observation may be made in regard to our private universities and the corporations for research established by Mr. Carnegie and Mr. Rockefeller. It is a fine thing that private means should be so used; it is humiliating that the taxation of steel and kerosene and the use of the proceeds should be left to individual caprice instead of being attended to by the state. Monopolies by which it is possible to charge more for a service than it costs must be controlled or conducted by the state. In like manner services rendered not to an individual but to society must be paid for by society. The most important of these services are creation in science and the bearing and rearing of children. Their performance is dependent on fundamental instincts implanted for their use to the race rather than to the individual and liable to atrophy or perversion under the artificial conditions of contemporary rationalism.

Under oligarchic institutions scientific research may be a by-product of the leisure classes and may be rewarded by patronage and honors; the bearing of children may be encouraged by non-rational patriotic and religious sanctions. In a democratic society research should be paid for by the state and the cost of bearing, rearing and educating children should be shared equally by all. Apart from the individual joy and profit in living—whatever that may be—each youth twenty years of age not below the average in endowment is economically worth to the state at least $10,000 in that he will produce so much wealth in excess of what he will consume. The exceptional individual may be worth a hundred million dollars. It is the business of the state—its principal business—with one hand to provide for the advancement of the material sciences and the sciences concerned with human conduct, with the other hand to care

for the production of well-born children and their preparation for the work for which they are fit.

Existing conditions would be discouraging if they were a relapse from better things; but this is by no means the state of affairs. The defects of our system of education, our lack of distinction in science, art and letters, the shortcomings of our political and social institutions, are due in larger measure to the survival of standards and traditions from a predemocratic world than to the difficulties inherent in a democracy. We may complain of our simplicity and crudeness, of our waste and incompetence, of our selfishness and corruption, but this only means that human nature and human conduct are what they are. Montesquieu was doubtless correct in saying that virtue is the principle of democracy, but of what social or political system is it not the basis? In what other nation would the people respond to the call of the primitive virtues with so much alacrity as here under the leadership of men such as Mr. Roosevelt, Mr. Wilson and Mr. Bryan? While virtue is essential to a nation, intelligence is desirable. The state should not neglect the advancement of science and be content to provide a hereditary system of education handed down from generation to generation. The Chinese have learned better.

The way to improve our educational work is to make the career of the teacher such that the wisest men and women of the country may be drawn to it, and then to give them opportunity and encouragement to develop a science of education and to apply it. In our universities, especially in our state universities, we have laid the foundations. The national government in its land grants to colleges of agriculture and the mechanic arts, in its bureau of education and in other directions, has accomplished something, but not enough. The secretary of a department of education and science should be the ablest man in the country, the president only excepted. The federal government can make the most noteworthy advance by the establishment of a national university at Washington to coordinate the work of its departments, to advance science and education, to set standards to the states. The ideals of a people must be symbolized in institutions. To substitute a constitution for a crown is futile. The ideals of a democracy can best be embodied in a great national university. We should then join with other nations in the establishment of an international university.

It is clearly impossible in a forty-minute address to discuss the contents and methods, the objects and results, of education, from the kindergarten to the university, from the crib to the death-bed. It is exactly those subjects on which we are most ignorant that can be talked about most endlessly. I have not hesitated to express opinions on various occasions[3] and have indicated some of them in the course of these remarks. But my plea is that the time has now come when opinions, traditions and rule-of-thumb methods should yield to a science of education. Feeble infant as is this section of education of the American Association for the Advancement of Science, it has more promise of development than the best organized political party or the most richly endowed denominational church. It is the old story—"The harvest truly is plenteous, but the laborers are few." If we could only realize what it would mean to have a science of education, a science of health, a science of conduct, surely all the resources of our civilization

[3] For example, in three addresses published in *The Popular Science Monthly*, "Concerning the American University" (June, 1902), "The School and the Family" (January, 1909), and "The Case of Harvard College" (June, 1910).

would be turned in this direction. And they will be. The progress of the physical sciences in the nineteenth century will in the coming century be paralleled by advances in the psychological sciences. Science and education have given us democracy; it is the duty and the privilege of democracy to repay its debt by forwarding science and education to an extent not hitherto known in the world's history.

J. McKeen Cattell

THE PROFESSORSHIP OF PHILOSOPHY AND PSYCHOLOGY AT LAFAYETTE COLLEGE

At a largely attended joint meeting of the American Philosophical Association and the American Psychological Association, held at New Haven, December 31, 1913, the report of a committee appointed to inquire into the circumstances connected with the resignation of Dr. John M. Mecklin from the professorship of philosophy and psychology at Lafayette College was read and approved, *nemine contradicente,* and ordered printed. The committee was composed of Professors A. O. Lovejoy, of Johns Hopkins (*Chairman*), J. E. Creighton, of Cornell; E. Hocking, of Yale; E. B. McGilvary, of Wisconsin; W. T. Marvin, of Rutgers; G. H. Mead, of Chicago, and H. C. Warren, of Princeton. The report involves principles of general interest to American university teachers and administrators; and the more essential parts are, therefore, here reproduced at length.

The committee's understanding of the scope and purposes of its inquiry is set forth in its original letter to Dr. E. D. Warfield, president of the college:

The function of the committee is primarily to secure an authoritative statement of the facts in the case which can be laid before the members of the associations (of both of which Professor Mecklin is a member) at their approaching annual meetings, for their information. The concern of these bodies in the matter is twofold. They consist for the most part of members of the university teaching profession, and they are therefore anxious to ascertain the reason for any action which may have the effect of injuring the professional standing and opportunities of any of their own members. It would seem, in the second place, desirable that the members of these associations should know somewhat definitely what doctrinal restrictions are imposed upon teachers and investigators in philosophy and psychology in the principal American institutions of learning. Such knowledge it is important to our members to have, both in order that their action in making recommendations for positions and the like may be guided thereby, and also that in their judgment of the department of philosophy and psychology in any institution, they may bear in mind the predetermined limits of liberty of opinion which affect the tenure of professorships in that institution. It has been publicly asserted that restrictions of this kind obtain at Lafayette College.

In its attempt to secure the desired information the committee, of course, turns first to yourself and to Professor Mecklin. We shall therefore be greatly obliged if you will let us know whether the statements already published in Science and the *Journal of Philosophy* regarding the circumstances of Professor Mecklin's resignation seem to you accurate, and what your understanding is as to the doctrinal requirements imposed upon professors of philosophy and psychology at Lafayette. The points about which we especially desire to be informed are indicated by the accompanying questions; we shall be obliged if, as an aid to giving definiteness to any statement which the committee may prepare on the subject, you will cover these questions in the reply which we hope you will be good enough to let us have.

The appended questions were as follows:

1. Was the resignation of Professor Mecklin called for by the administrative authorities of Lafayette (*a*) because of certain doctrines held or taught by him; or (*b*) because of certain doctrines contained in the text-books used by him?

2. In either case, what, specifically, were the opinions or teachings to which objection was made?

3. Are the statements made by Professor Mecklin in *The Journal of Philosophy* of September 25, 1913, regarded by the administrative authorities of Lafayette College as giving a substantially accurate and sufficient account of the facts in the case?

4. Is subscription to any specified creed a requisite to appointment to a professorship in Lafayette College?

5. Are the professors of philosophy and psychology required, so long as they hold their positions,

to conform their teachings to any specified creed or doctrine?

6. If so, what is this creed?

7. Are similar requirements imposed upon professors of other departments, such as biology and geology?

8. In case of alleged deviation by any professor from the doctrinal standards of the college, by whose interpretation of these standards is such deviation determined?

To these inquiries the committee reports that it has been unable to secure any definite answers from the president of Lafayette. After a month's delay, a reply to the above letter signed by President Warfield, the president of the board of trustees and the chairman of the curriculum committee, was received; but it "could be construed by the committee only as a courteous declination to furnish the definite information desired." A subsequent letter from President Warfield "accentuated this declination." The first of these communications does, however, contain at least one statement which a member of the board of trustees formally declares to the committee to be "not in accordance with the facts." In spite of this refusal of information by the college administration, the committee secured a large mass of evidence from other sources—trustees, members of the faculty, and former students under Professor Mecklin—and arrived at certain conclusions bearing upon three general questions. The committee's findings upon each of these are in part as follows:

I. *What, before the present case arose, has been the accepted understanding as to the limits of freedom in philosophical and psychological teaching at Lafayette College?*

American colleges and universities fall into two classes: Those in which freedom of inquiry, of belief and of teaching is, if not absolutely unrestricted, at least subject to limitations so few and so remote as to give practically no occasion for differences of opinion; and those which are frankly instruments of denominational or political propaganda. The committee does not consider itself authorized to discuss the question whether the existence of both sorts of institution is desirable. If, therefore, the present case were one in which a teacher in a professedly denominational college had in his teaching expressly repudiated some clearly defined and generally accepted doctrine of that denomination, the committee would not feel justified in proceeding further with the matter. These associations should, in the committee's opinion, intervene in questions of this sort only for three ends: (1) To ascertain which institutions do, and which do not, officially profess the principle of freedom of teaching; (2) to ascertain, with a fair degree of definiteness, in the case of those institutions which do not, what the doctrinal limitations imposed upon their teachers of philosophy and psychology are; and (3) to call attention publicly to all instances in which, in institutions of the former sort, freedom of teaching appears to have been interfered with, or in which, in institutions of the latter sort, restrictions other than those antecedently laid down appear to have been imposed.

Upon the question whether Lafayette is to be classed with institutions of the first or second type, the committee finds a surprising measure of disagreement among officers, teachers and graduates of the college. Article VIII. of the college charter provides:

"That persons of every religious denomination shall be capable of being elected trustees, nor shall any person, either as principal, professor, tutor or pupil, be refused admittance into said college, or denied any of the privileges, immunities or advantages thereof for or on account of his sentiments in matters of religion."

In accordance with this clause of the charter, a trustee writes the committee as follows:

"I need not remind you that Lafayette College is not a theological institution, nor does it profess to teach or impose upon its teachers or students, any creed or doctrinal religious standards. . . . Whatever may be Dr. Mecklin's impression of the attitude of the president, so far as the trustees and faculty of the institution are concerned, I know of no policy or shaping thereof that in any way involves the recognition or inculcation of any sectarian creed, Presbyterian or otherwise, much less any particular type of Presbyterianism." This interpretation of the charter—which is obviously in harmony with its text—is evidently shared by other members of the board of trustees.

On the other hand, the testimony of some members of the faculty, and that of President Warfield and two trustees, is that there is a general assumption that the teaching of professors must be in harmony with the doctrinal standards of the Presbyterian Church. The General Catalogue

(1912–13) contains the following statement (p. 146):

"The aim of Lafayette College is distinctly religious. Under the general direction of the Synod of Pennsylvania of the Presbyterian Church, its instruction is in full sympathy with the doctrines of that body. At the same time religious instruction is carried on with a view to a broad and general development of Christian character, within the lines of general acceptance among Evangelical Christians, the points of agreement, rather than those of disagreement, being dwelt upon."

The last sentence would appear to indicate the understanding upon which Professor Mecklin accepted the call to the professorship of philosophy and psychology in 1904; he writes that he then and at all times recognized that his teaching, "as well as that of every other professor," was to be "in accord with Christianity in the broad Evangelical interpretation of that term."

Here, then, would appear to be three distinct views of the position and policy of the college: It is committed to no specific creed; it is committed only to the principles of "Evangelical Christianity"; and it is committed to the principles of the Presbyterian Church. The committee, for the rest of this report, assumes that substantially the last-mentioned view is to be taken as the answer to the first question,—that, in the words of a trustee, it has been "commonly understood that the teachings in such departments [*i. e.*, those of philosophy and psychology] are in general to be in harmony with the doctrines of philosophy usually taught and held in the Presbyterian Church." But the committee can not but think it highly undesirable that in any college a question of such importance should be left open to such divergent official answers; and it appears of doubtful legality that the prevailing practise in the matter should be in express contradiction with an unrepealed clause in the college charter.

II. The second question which the committee has endeavored to answer is: *What were the actual grounds upon which Professor Mecklin's resignation was asked for, and what do these indicate as to the doctrinal limitation imposed upon professors in philosophy and psychology under the present administration of the college?* Upon this the committee's findings are as follows:

1. No connected and altogether definite statement seems ever to have been formulated of the specific points in Professor Mecklin's teaching to which objection was made, or of the manner in which these were held to conflict with Presbyterian principles. A member of the board of trustees of the college, who was present at the meeting of the curriculum committee at which the matter was first brought forward, states that he was unable from the discussion at that meeting, or in any other way, to ascertain precisely on account of what charges as to doctrines held or taught by him Professor Mecklin was dismissed. This trustee writes that the accusations of erroneous doctrines or opinions made against Professor Mecklin at this meeting "were indefinite and as far as I am concerned remain so to this present time." Another correspondent conversant with the facts writes the committee that the president of the college simply asserted that "the doctrines set forth in certain text-books adopted by Professor Mecklin, viz., Angell on Psychology, Dewey and Tufts on Ethics, McDougall on Social Psychology, and Ames on the Psychology of Religious Experience, were a departure from the doctrines that had been taught in the college in previous years. No definite statement was ever made by the president to the board of trustees, so far as I recollect, of the exact teachings to which he made objections, other than the general objections to the text-books above mentioned, and a general and indefinite statement that the teachings of Professor Mecklin were not in harmony with the traditional teachings of the college in the department of philosophy. Previously to Professor Mecklin's occupying the chair of philosophy, the teaching in that department had for some years been by Presbyterian clergymen who devoted a portion of their time thereto, but did not undertake to present to the student any clearly defined system of philosophical instruction. Professor Mecklin undertook to introduce such a system of instruction, in line with other first-class educational institutions, some of which were well-known Presbyterian colleges, and used in connection therewith, among others, the text-books above mentioned. Some of his teachings as inferred from the said text-books were objected to by the president as contrary to the traditional teaching of the college on these subjects. The board of trustees did not pass upon the questions raised, although they discussed them, and there was a difference of opinion among them on the subject. Some of the trustees, feeling it desirable that a controversy of a religious or denominational aspect should be avoided, thought it wisest, in view of all the circumstances, to advise Professor Mecklin to resign rather than have the

discussion proceed to a vote, which might or might not have been in his favor.'' There seems, in short to be no general and clear understanding among the members of the board of trustees and the faculty of the college as to the precise doctrinal grounds upon which the president's insistence on Professor Mecklin's dismissal was based. It is the opinion of the committee that in no institutions, of whatever type, should a professor be compelled to relinquish his position for doctrinal reasons, except upon definite charges, communicated to him in writing and laid, with the supporting evidence, before the entire board of trustees and the faculty; and that it is unfortunate in any case of this kind that, even by agreement between the persons concerned, the matter should fail to be brought to an explicit issue before the responsible governing body of the institution.

The committee, however, reports that, so far as can be determined in the absence of definite charges, the president's original and decisive objection to Professor Mecklin's teaching was, in the words of another professor at Lafayette, "based upon Dr. Mecklin's use of the doctrine or theory of evolution in his discussion of the growth of religion."

The committee observes that "as a body it has no competency to discuss whether or not the doctrines and text-books in question are or are not in harmony with Presbyterian standards." With regard, however, to the restrictions now imposed at Lafayette the committee reports as follows:

The committee is forced to conclude that at Lafayette College at the present time tenure of the professorship of philosophy and psychology is, in practise, subject not only to the requirement that the teachings of the incumbent shall be in substantial harmony with the commonly accepted doctrines of the Presbyterian Church, but also to the requirement that his teachings shall be in substantial harmony with the theological opinions of the administrative authorities of the college, and with their interpretation of the philosophical implications of those opinions. The committee also concludes that the statement of the Lafayette College Catalogue, that the religious instruction there ''is carried on within the lines of general acceptance among evangelical Christians, the points of agreement, rather than those of disagreement, being emphasized,'' is not accurately descriptive of the present policy and practise of the college. The committee further gathers from various evidence brought to its knowledge that the administration of the college disapproves of the mere presentation to the students, through text-books or collateral reading, of any philosophical views which it regards as seriously erroneous, and discourages instruction which has the effect, as Professor Mecklin's evidently had, of provoking thought and stimulating discussion and debate among the students upon philosophical and religious issues.

III. The third general question taken up by the committee concerns the attitude of the administrative authorities of Lafayette College towards the committee's inquiry. This attitude, as indicated above, was one of unwillingness to give the information asked for. Upon this the report makes the following comments:

It is true that President Warfield [in his last letter to the committee] gives as a reason for his refusal to make ''a statement with regard to these matters'' a formal request by ''those who were recognized as speaking for Professor Mecklin'' that ''no information should be given out with regard to what took place before the board of trustees except that after the consideration of a report from the curriculum committee Dr. Mecklin offered his resignation which was accepted and that he was granted a year's salary.'' President Warfield thus represents his reticence as actuated, at least in part, by a deference to Professor Mecklin's wishes. Upon this matter Professor Mecklin makes the following statement to the committee: that no such request was made to the trustees by his authority, that, on the contrary, he regarded such a policy of secrecy about the causes and circumstances of his resignation as unfair to him and likely to be detrimental to his professional reputation; that he expressly informed a committee of the trustees which conferred with him that he desired no concealment of the grounds for the action taken; that he has publicly given evidence that such was his desire, by his letter on the case, published in *The Journal of Philosophy;* and that his wish that the facts should be fully made known has come within the knowledge of President Warfield. Your committee notes, also, that there was published in the Philadelphia *Public Ledger* of June 20, 1913, a long and circumstantial (though incomplete) statement (already referred to) by Dr. Warfield respecting Dr. Mecklin's resignation; it can not, therefore, be said that hitherto ''no information'' has been ''given to the public with regard to what took place be-

fore the board of trustees,'' beyond that contained in the letter above cited. In view of these circumstances the committee finds itself unable to suppose that the decisive reason for President Warfield's reluctance to answer its inquiries is his consideration for the interests and wishes of Professor Mecklin. The committee notes, moreover, that two out of the three questions last laid before President Warfield asked for information, not about the resignation of Professor Mecklin, but about the general policy of the college and the specific credal requirements attaching to the professorship of philosophy and psychology. These inquiries, also, President Warfield has declined to answer. He intimates, indeed, that he regards it as improper for persons not connected with the college to ask, or for him to answer, ''questions concerning the college or its members.''

The attitude thus assumed does not seem to this committee one which can with propriety be maintained by the officers of any college or university towards the inquiries of a representative national organization of college and university teachers and other scholars. We believe it to be the right of the general body of professors of philosophy and psychology to know definitely the conditions of the tenure of any professorship in their subject; and also their right, and that of the public to which colleges look for support, to understand unequivocally what measure of freedom of teaching is granted in any college, and to be informed as to the essential details of any case in which credal restrictions, other than those to which the college officially stands committed, are publicly declared by responsible persons to have been imposed. No college does well to live unto itself to such a degree that it fails to recognize that in all such issues the university teaching profession at large has a legitimate concern. And any college hazards its claim upon the confidence of the public and the friendly regard of the teaching profession by an appearance of unwillingness to make a full and frank statement of the facts in all matters of this sort.

The report is published in full in the *Journal of Philosophy, Psychology and Scientific Methods* for January 29, 1914.

SCIENTIFIC NOTES AND NEWS

Dr. Calvin Milton Woodward, emeritus professor of mathematics and applied mechanics and dean of the school of engineering and architecture of Washington University, past president of the American Association for the Advancement of Science, of the board of regents of the University of Missouri and of the St. Louis Board of Education, died from apoplexy on January 12, aged seventy-seven years.

Sir David Gill, the distinguished British astronomer, for many years astronomer at the Cape of Good Hope, died on January 24, at the age of seventy years.

Colonel William C. Gorgas has been nominated to be surgeon-general of the army of the United States, with the rank of brigadier-general.

Dr. S. S. Goldwater has been appointed commissioner of health for New York City to succeed Dr. Ernst J. Lederle.

Charles W. Eliot, president emeritus of Harvard university, had been elected a trustee of the Rockefeller Foundation for the term of three years.

Dr. J. S. Haldane, reader in physiology at Oxford, has been chosen as Silliman lecturer at Yale University for next year.

The organizing committee, selected by the American members of the international committee of the Second International Eugenics Congress, has met in New York City and unanimously elected Dr. Henry Fairfield Osborn as president of the congress. Dr. Alexander Graham Bell was elected honorary president. The congress will be held in New York City near the end of September, 1915.

Professor Andrew C. McLaughlin, head of the department of history in the University of Chicago, was elected president of the American Historical Association at its recent meeting in Charleston, South Carolina.

At the recent annual meeting of the American Anthropological Association held in New York City, Professor Roland B. Dixon, of Harvard University, was reelected president; and Professors Franz Boas, of Columbia University, and George Grant MacCurdy, of Yale University, were designated to represent the association at the International Congress of Americanists, to be held in Washington, D. C., October 5 to 10, 1914.

WE learn from *Nature* that an institution of petroleum technologists has been formed in London with Sir Boverton Redwood, Bart., as president. Dr. D. T. Day, of the U. S. Geological Survey, and Professor C. Engler have been elected honorary members.

THE Geological Society of London will award its medals and funds as follows: Wollaston medal, Dr. J. E. Marr, F.R.S.; Murchison medal, W. A. E. Ussher; Lyell medal, C. S. Middlemiss; Wollaston fund, R. B. Newton; Murchison fund, F. N. Haward; Lyell fund, Rev. W. Howchin and J. Postlethwaite.

THE prizes in astronomy of the Paris Academy of Sciences have been awarded as follows: the Lalande prize to J. Bosler, for his researches on the sudden variations of terrestrial magnetism and their connection with disturbances in the sun; the Valz prize to Professor Fowler, for his researches in spectroscopy; the G. de Pontecoulant prize to M. Sundmann, for his researches on the problem of three bodies.

DR. ALEŠ HRDLIČKA, of the U. S. National Museum, has been named a titular member of the Société Impériale Des Amis D'Histoire Naturelle, D'Anthropologie et D'Ethnographie, Moscow, Russia.

PROFESSOR W. C. FISCHER, recently compelled to relinquish his chair at Wesleyan University, was a candidate for mayor of Middletown at a recent election, but was defeated by a vote of 699 to 689.

DR. CARL SKOTTSBERG, lecturer on botany and keeper of the herbarium at the University of Upsala and Dr. C. H. Ostenfeld, of the Botanical Museum at Copenhagen, have been visiting American botanical institutions.

As the first half of the Washington-Paris longitude campaign has been completed, the last few weeks have been devoted for the most part to exchange of observers. Mr. G. A. Hill and his party have returned to Washington, and the party headed by Professor F. B. Littell, U. S. N., has departed for Paris. The new French representatives are Professor E. Vienet, of the Paris Observatory, and Ensign P. Auverny, of the French navy.

NEWS has been received from Dr. William E. Farabee, who is now in Brazil directing the University of Pennsylvania Expedition in the Amazon regions. The expedition had passed through the territory inhabited by the Macusi Indians, and was starting, with forty porters, through the Wai Wai country into unexplored parts of French and Dutch Guiana.

DR. W. T. HORNADAY, director of the New York Zoological Park, will give a course of lectures as a part of the regular work at the Yale Forest School on wild animal life and its conservation. The titles of the five lectures in the course are as follows: "The Extinction of Valuable Wild Life," "The Feathered Allies of the Farmer and Forester," "The Legitimate Utilization of Wild Birds and Mammals," "Wild-animal Pests and their Rational Treatment," "The Duty and Power of the Citizen in Wild Life Conservation."

A COURSE in industrial organization and scientific management will be given at Brown University during the second semester of the present year. A feature of the course will be three or four lectures monthly by business men and efficiency experts. The first of these lectures, which will be open to the public, will be given on February 19 by Professor H. S. Person, director of the Tuck School of Administration and Finance, Dartmouth College, on "Different Types of Management."

ON January 8 Professor Theobald Smith delivered a lecture on "Prophylactic and Therapeutic Vaccines" before the New York State Veterinary College at Cornell University.

DR. ARTHUR L. DAY, director of the Geophysical Laboratory of the Carnegie Institution of Washington, lectured before the Geographical Society of Chicago on January 23 on "Some Observations on the Volcano Kileauea in Action."

MR. FRANCIS S. PEABODY, president of the Peabody Coal Company of Chicago, Illinois, recently gave a lecture before the college of engineering of the University of Illinois on "The Mining and Utilization of Illinois Coal." The lecture was illustrated with excel-

lent motion pictures taken underground in actual coal mines. They are the first successful motion pictures taken underground, and they give a vivid idea of the actual conditions met in coal mining.

On January 20, Professor W. Bateson began a course of six lectures at the Royal Institution on animals and plants under domestication. Beginning on January 22, Mr. W. McDougall gave a course of two lectures on the mind of savage men. The Friday evening discourse on January 23 was delivered by Sir James Dewar on "The Coming-of-age of the Vacuum Flask."

A memorial to Captain Scott will be unveiled on February 5 on the Col de Lautaret in the French Alps, whither the British explorer went in March, 1908, to make a trial of his motor sleighs.

John James Rivers, born in England on January 6, 1824, known for many years as a naturalist on the Pacific coast, died at his home in Santa Monica, California, on December 16, 1913.

The death has occurred, in his eighty-fourth year, of Mr. John Phin, the author of popular scientific books, and formerly editor of several New York technical papers.

The death is announced of Dr. A. F. Le Double, professor of anatomy at the School Médécine in Tours, France. Professor Le Double was an indefatigable worker and published a number of works of special value to anatomy and anthropology on the variations of the muscular system, of the bones of the skull, those of the face and those of the spine. Death overtook him in the sixty-sixth year of age and in the midst of preparation of further work on the variations of the human system.

The U. S. Civil Service Commission announces an examination for assistant in road economics, to fill a vacany in this position in the office of public roads, Department of Agriculture, Washington, D. C., at a salary of $1,500 a year.

The council of the Royal Geographical Society has made a grant of £1,000 towards the expenses of Sir Ernest Shackleton's trans-antarctic expedition.

Work has begun on the Magee Hospital for maternity cases at Pittsburgh to be erected at a cost of $800,000 provided by the late Christopher L. Magee as a memorial to his mother. The hospital is affiliated with the school of medicine of the University of Pittsburgh.

Messrs. Samuel and Harry Sachs, to perpetuate the memory of their parents, the late Joseph and Sophie Sachs, have given to Mount Sinai Hospital, New York, the sum of $125,000 to endow two neurological wards. The hospital will receive the sum of $100,000 under the will of Benjamin Altman and has received a $100,000 legacy from Mrs. Louis W. Neustader.

The Russian ministry of the interior has given consent to the free admission of Jewish members of the twelfth International Ophthalmological Congress, to be held at St. Petersburg from July 28 to August 2, but it limits the time they can stay in the country to September 15. In view of this restriction, Professor Julius Hirschberg, president of the Berlin Ophthalmological Society, has proposed that opthalmologists should refrain from attending the congress.

Marchese Raffaele Capelli, president of the tenth International Congress of Geography, has communicated to the U. S. Geological Survey, the following resolution adopted by the recent congress, on motion of M. Le General Schokalsky:

> The Tenth International Congress of Geography approves the impulse given to the project of an atlas of forms of terrestrial relief and the commencement of the execution of the work. It strongly recommends to all geographers and to the scientific institutions to aid this enterprise in every manner.

He requests that wide circulation be given to this resolution of the congress, in order to obtain cooperation on the part of the geographers of different countries.

In accordance with plans recently formulated by a special committee appointed by the secretary of agriculture whose recommenda-

tions have been approved by him, announcement is made of a general change to begin January, 1914, in the character of the *Monthly Weather Review* and the *Bulletin of the Mount Weather Observatory*. These two periodicals which have hitherto appeared separately (*i. e.*, the *Monthly Weather Review*, largely devoted to statistical data and notes on current weather conditions, and the *Bulletin of the Mount Weather Observatory*, embodying a portion of the research work done by the bureau) will be merged into a single publication. The new series will retain the former well-known title, *Monthly Weather Review*. It will contain contributions from the officials of the Weather Bureau engaged in research work of any kind bearing on the atmosphere, and its pages will be open also to others working along similar lines. It will not contain the detailed tables for the twelve large climatological districts that have appeared in the *Review* since July, 1909, but tables giving a general summary of the data from the "full reporting stations" of the Bureau, about 200 in number, will still appear as in the past. Beginning with January, 1914, the statistics now assembled to form these detailed tables for the twelve large climatological districts, defined by great watersheds, will continue to be assembled in tables similar to these, but will be arranged by states instead of districts. The tables for each state will form one report prepared at the section center of that state, except in the case of the New England States, which will appear as a single section; and Maryland, Delaware, and the District of Columbia will also be grouped into a single section. The total number of these sections will be 42. These detailed summaries by states will each contain from 8 to 12 pages of data and charts and will be issued from ten to twenty days after the close of each month; they will thus meet the need for prompt dissemination in each state of the information they contain better than is possible under the present policy of collecting them at the Central Office into a single monthly.

THE Russian empire, covering one seventh of the land area of the globe and only sparsely settled in spite of its nearly 170,000,000 inhabitants, offers an interesting subject for study for both business men and economics. This country to-day presents a picture of economic development comparable with that of the United States of three or four generations ago, in that Russia is now chiefly a producer of the raw materials derived from nature, such as grain, timber, hides and minerals, and is just beginning to develop manufacturing industries of importance. Its exports are almost entirely foodstuffs and raw and semi-manufactured products, while it imports nearly all of the higher grades of manufactures which its people require. The total value of the foreign trade of European Russia, in 1912, according to official figures, was more than $1,200,000,000, in which the United States participated to the extent of only $53,000,000. However, the indirect trade between the two countries passing through foreign middlemen brings the value of the sales of American products to Russia to $80,000,000, and the exports from Russia to the United States to $30,000,000. Largely owing to the lack of knowledge among American business men of the possibilities of the Russian market, the trade between the two countries is on the threshold only of its possible development. The monograph on Russia just published by the Bureau of Foreign and Domestic Commerce, of the Department of Commerce, entitled "Handbook on Russia," should therefore be of special interest. This book contains nearly 260 pages, with two maps, and includes a comparative description of the economic situation in European Russia, by Consul General John H. Snodgrass, stationed at Moscow; reviews of the commerce of various districts in 1912, by the American consuls stationed in Russia, and a very timely description of commercial and industrial conditions in Siberia, by Consul John Jewell, stationed at Vladivostok. To those who still regard that country as a frozen waste, the picture presented by Mr. Jewell will be a revelation. He compares Siberia to-day with Canada of a generation ago, and points out the possibili-

ties of great trade development that lie in the great natural resources of the country.

The committee appointed by the Paris Academy of Sciences to allocate the grants from the Bonaparte Fund for the year 1913 have, as we learn from *Nature*, made the following proposals: Out of sixty-three applications the committee recommends twenty-one grants.

3,000 francs to H. Caillol, for the publication of his catalogue of the Coleoptera of Provence.

2,000 francs to A. Colson, for apparatus required for his work in physical chemistry.

2,000 francs to E. Coquidé, to assist him in his study of the means of utilizing peaty soil.

2,000 francs to C. Schlegel, for the continuation of his researches in the laboratory of M. Delage.

6,000 francs, in equal parts, between MM. Pitard and Pallary, for assistance in the continuation of their scientific work in Morocco.

2,000 francs to Jules Welsch, for his geological work on the coasts of western France and Great Britain.

2,000 francs to Louis Roule, for continuing and extending his researches on the morphology and biology of the salmon in France.

2,000 francs to Jean Pougnet, for the continuation of his researches on the chemical and biological action of ultra-violet light.

2,000 francs to C. Dauzère for his work on cellular vortices.

2,000 francs to Méd. Gard, for the publication of a work and atlas on material left by the late M. Bornet.

4,000 francs to Aug. Chevalier, to meet the expense necessitated by the classification of the botanical material arising from his expeditions in Africa.

2,000 francs to Paul Becquerel, for the continuation of his physiological researches relating to the influence of radio-active substances upon the nutrition, reproduction and variation of some species of plants.

4,000 francs to Le Morvan, for assistance in publishing the photographic atlas of the moon.

2,000 francs to Jacques Pellegrin, to assist him to pursue his researches and publish works on African fishes.

3,000 francs to E. Rengade, for a systematic research on the presence and distribution of the rare alkali metals in mineral waters.

3,000 francs to Charles Alluaud, for the publication of work on the Alpine fauna and flora of the high mountainous regions of eastern Africa.

2,000 francs to Charles Lormand, for the purchase of a sufficient quantity of radium bromide to carry out methodical researches on the action of radio-activity on the development of plants.

2,000 francs to Alphonse Labbé, for researches on the modifications undergone by animals on changing from salt to fresh water or the reverse.

3,000 francs to G. de Gironcourt, for the publication of the scientific results of his expeditions in Morocco and western Africa.

3,000 francs to A. F. Legendre, for the publication of maps and documents of his expeditions in China.

2,000 francs to H. Abraham, for the determination of the velocity of propagation of Hertzian waves between Paris and Toulon.

UNIVERSITY AND EDUCATIONAL NEWS

The General Education Board has given $750,000 toward an endowment of $1,500,000 for the medical department of Washington University, St. Louis, to create full time teaching and research departments in medicine, surgery, and pediatrics. The conditions of the gift provide that all teachers in these departments, while free to render any medical or surgical service, must not derive therefrom any personal gain. Their entire time must be devoted to hospital work, to teaching and research in their several specialties, as it is believed that medical education in the past has suffered from the fact that the teachers have had to rely on private work for the major portion of their income. The General Education Board has also made conditional grants of $100,000 each to Knox College, Galesburg, Ill., and to Washburn College, Topeka, Kan.

ANNOUNCEMENT was made at a meeting of the Yale Corporation on January 19 that gifts and pledges of $350,000 had been obtained for the development of the Yale Divinity School into a university school of religion. These gifts will increase the endowment of the school to over $1,200,000. Among the gifts were $100,000 from Mrs. D. Willis James and Arthur Curtiss James, of New Haven; $80,000 from Mrs. Stephen Merrell Clement, of Buffalo, N. Y., and an anonymous gift of $100,000, the latter to found a chair of social service.

THE trustees of Vassar College have announced that as President Taylor's resignation, which he presented a year ago, is to take effect February 1, in accordance with his wishes, and as no new president has been appointed, the administration of the college will be carried on by committees of trustees and faculty. Professor Herbert E. Mills, head of the department of economics, will act as chairman of the faculty.

ON January 9 and 10 occurred the first annual convention of the Stevens Institute of Technology. The convention opened with a symposium on "An Engineer's Part in the Regulation of Public Utilities." President Humphreys acted as chairman of the meeting, and papers were read by him and by several other Stevens alumni. Other features of the convention were the midwinter alumni meeting, a conference of Stevens Clubs, a trip to the Brooklyn Navy Yard and the alumni dinner at the Hotel Astor.

DR. E. A. FATH, director of Beloit College Observatory, has resigned his position to accept the presidency of Redfield College of Redfield, S. D. He will take up his new work about March 1.

DR. HENRY WINSTON HARPER, professor of chemistry in the University of Texas, Austin, has been made dean of the graduate department.

DR. CREIGHTON WELLMAN, dean of the school of hygiene and tropical medicine of the Tulane University of Louisiana, has resigned this position.

PROFESSOR F. L. STEVENS has resigned the position of dean of the College of Agriculture, Mayaguez, Porto Rico, to become professor of plant pathology in the University of Illinois.

DR. WILLIAM DUANE has been appointed assistant professor of physics in Harvard University. He has spent six years in the Curie Radium Laboratory at Paris, and last fall returned to this country as research fellow of the cancer commission of Harvard University. Professor Duane will devote the greater part of his time to the physiological action of radioactive substances and to the problems in physics directly conected with this subject at the Harvard Medical School and at the Huntington Cancer Hospital, but he will also undertake the direction of advanced students in problems on the purely physical side of radioactivity in the Jefferson Physical Laboratory.

DR. H. F. BAKER, F.R.S., fellow and lecturer of St. John's College, and Cayley university lecturer in mathematics, has been elected Lowndean professor of astronomy and geometry at the University of Cambridge in succession to the late Sir Robert Ball.

DISCUSSION AND CORRESPONDENCE

TUBERCULOSIS FOLLOWING TYPHOID FEVER

IN SCIENCE for 1908, Professor W. T. Sedgwick, of the Massachusetts Institute of Technology, called attention to the remarkable discovery by Reincke, of Hamburg, and Mills, of the United States, that when an infected water supply of a community was improved by filtration or otherwise, not only did typhoid fever diminish, but other diseases also, such as tuberculosis. Hazen calculated that for every typhoid death prevented, two or three were saved from death by other diseases. Sedgwick and MacNutt subsequently published their full paper in the *Journal of Infectious Diseases,* and the former in still another paper in a symposium on "Tuberculosis in Massachusetts," 1908, stated that as a rule infected waters increased the death rate from tuberculosis and purification of water decreased the rate.

For some time I have been collecting data which enable us to extend these generalizations still further. It has been found that tuberculosis follows typhoid fever far more frequently than physicians have suspected, and moreover the tuberculosis mortality curve of a nation is almost always parallel to that of typhoid fever. Cities do not show such a close agreement as the country as a whole, because consumptives quite commonly leave the city to die elsewhere. As far as the very defective statistics permit a conclusion, it is to the effect that consumptives have had much more typhoid fever than the rest of the population. We have long known of the serious after effects of typhoid fever, but only recently have a few physicians been calling attention to the far-reaching nature of these sequelæ. Tuberculosis is only one of these results. That is, by reducing typhoid fever in any way whatever we save far more from death by numerous other conditions due to the lessened resistance caused by the typhoid infection. The purification of a water supply is then only one of the numerous ways of reducing tuberculosis.

The explanation of the phenomenon is evident. By personal inquiries of physicians in the United States, Germany, Switzerland, France and Great Britain, I find that the following facts seem proved to the minds of those who by special study are competent to form an opinion. Babies are born free of tuberculosis, but begin to acquire it as soon as they can crawl around, pick up the bacilli with dust and dirt, and immediately convey them to the mouth after the manner of all babies. These germs are weakened or attenuated by sunlight, drying, etc., and are not able to spread actively, though they establish themselves. Those which are taken in by the phagocytes have the same effect as vaccination and cause the production of antibodies which make us all more or less immune to infection by virulent bacilli. If a baby is infected by fresh virulent bacilli from a nurse, before its immunity is produced, it dies of rapid disseminated tuberculosis, but an adult is not harmed by the virulent bacilli he takes in. Indeed, there is no incontrovertible evidence that any adult ever acquires tuberculosis. If one develops active tuberculosis, it is not a new infection, but an activation of latent lesions he has been carrying since childhood. Something has happened to him which has caused a temporary lessening of his antibodies and allowed the latent tuberculosis to spread—and nothing is more potent in doing this than the infections like measles, whooping cough and typhoid fever. Without these activating causes a man may lose immunity very slowly by improper food, mental and physical exhaustion, living in badly ventilated rooms, lack of outdoor exercise and a thousand other ways of lowering general health, but if one in such a condition does acquire another infection like pneumonia, typhoid fever or influenza, his chances of becoming actively tubercular later are very large. Post-mortems of children almost always reveal tubercle, no matter what the disease was which caused death. Post-mortems of adults always show healed lesions, proving that at some time in our lives each of us lost resistance sufficiently to allow the lesions to become active, though we were later cured by a reestablishment of the immunity. One eighth or one tenth of us are unable to reestablish it and perish from tuberculosis. The facts are bound to modify the anti-tuberculosis crusade most profoundly.

Savages, living an outdoor isolated life, have no chance to encounter tubercle bacilli and consequently do not become immune. When they do come in contact with a case they run a rapidly fatal course—generally if not always disseminated or miliary. That is, tuberculosis did not become a human affliction until long after we began to cluster together in confined shelters—possibly not until after we began to construct huts, "dugouts" and houses.

The detailed data which prove the relationship of tuberculosis and typhoid fever will appear in *American Medicine* in January, but this preliminary note is published as an answer to the questions of Hazen and Sedgwick as to how we could explain the phenomenon of a decrease of tuberculosis by the

simple expedient of purifying the water supply.

CHARLES E. WOODRUFF

SCIENTIFIC BOOKS

Lectures on the Differential Geometry of Curves and Surfaces. By A. R. FORSYTH. University Press, Cambridge, 1912. Large octavo. Pp. xxiii + 585. Price, $8.

Professor Forsyth's skill and versatility in the writing of mathematical treatises, already proved by his well-known works on differential equations and the theory of functions, is again illustrated by this new volume, his first in the field of geometry. The lectures were delivered, in substantially their present form, during the author's tenure of the Sadlerian professorship at Cambridge. They make very interesting reading. The style is graceful, and the technical discussions are illuminated by many passages on the history and development of the special topics considered.

Naturally no attempt is made to cover the whole field of differential geometry. Not even the classic four-volume treatise of Darboux pretends to include all the applications of the methods of the infinitesimal calculus to the domain of geometry. In particular, the author omits all extensions to hyperspace and non-Euclidean geometries. His main aim is to "expound those elements with which eager and enterprising students should become acquainted," and to provide such students, who, later, may devote themselves to original work "with some of the instruments of research."

The author restricts himself to curves and surfaces in ordinary Euclidean space and uses the direct methods introduced by Gauss. "I have made no attempt to give what could only have been a rather faint reproduction of Darboux's treatment, which centers round the tri-rectangular trihedron at any point of a curve or surface or system. My hope is that students may experience an added stimulus when they find that different methods combine in the development of growing knowledge." It must be admitted that, by showing the power of the more natural methods (combined, of course, with typical Cambridge skill in analytical manipulation) in the solution of extremely difficult problems, the author's procedure is amply justified.

As regards logical rigor the work is about on a level with the texts of Bianchi, Scheffers, and Eisenhart. No attempt is made to lay precise function-theoretic foundations for the geometric structure which is erected. In particular the concepts of analytic curve and surface, employed throughout the work, are never formulated precisely. Professor Study's vigorous criticism of the new edition of Bianchi in this aspect applies in fact to all standard treatises on differential geometry. It must be confessed that the claims of rigor are not emphasized in geometry to nearly the same extent as in analysis. In this respect geometry in fact occupies a position between analysis and physics, and to that extent belongs to applied rather than to pure mathematics. Study has himself outlined a proper basis for the treatment of analytic curves,[1] but this has not yet been digested into a form suitable for an introductory text, and the corresponding discussion of surfaces is still to be undertaken. No doubt, in the future—how near one can not say—Study's high and beautiful ideal will become realized. Meanwhile, most geometers, at least when they write on differential geometry, follow the older and what they considered the most expedient approach. Perhaps a distinction should be made, even in the domain of graduate mathematics, between *pedagogic* books and *logical* books. The evolution toward a rigorous treatment (never perfect, but at least up to the highest standard of a given period of mathematics) is obviously inevitable.

As regards the introduction of *imaginary* configurations in geometry the author follows the traditional half-hearted policy of considering them only when it is convenient, or at least traditional, to do so. Thus, in connection with a real surface, it is analytically expedient to introduce certain curves, of course imaginary, whose length (between any two points) is zero. [These the author desig-

[1] In two memoirs published in the *Trans. Amer. Math. Soc.*, 1909, 1910.

nates as *nul* lines, a very good name in itself, but already in use in an entirely different sense in connection with the so-called nul-system of statics and line geometry, and furthermore unnecessary since the term *minimal* lines is quite standardized in the literature.] Again in connection with the problem of geodesic representation, the usual discussion of the real solutions of Beltrami and Dini is followed by the imaginary solutions discovered by Sophus Lie. If then imaginary figures are allowed even when, as in this last instance, they are, however interesting, really inconvenient, why not, as Study advocates, introduce them deliberately and systematically?

The student usually gets the impression that whatever is true in the real domain, will, by some very nebulous principle of continuity, also be true in the larger complex (real and imaginary) domain. This is actually the case in a remarkably large number of questions, but certainly not in all. The exceptional character of minimal curves has long been recognized, but only recently the peculiar curves lying in a minimal plane have been investigated by Study and his students.

Even in the domain of curves lying in an ordinary (Euclidean) plane, the reviewer has recently encountered a striking instance of how imaginary figures may have essentially different properties from real figures. It is a standard theorem in elementary calculus that when one point approaches another on a curve the arc and the chord becomes ultimately equal, that is, the ratio of the arc to the chord approaches unity as its limit. This property of real analytic curves is true of most imaginary curves, as can be verified by calculation, but not of all. In the simplest class of exceptional imaginary curves, the limit is a certain irrational number, approximately .94. Thus the arc, instead of becoming equal to the chord, becomes *less* (of course in absolute value, since both arc and chord are complex quantities). Again, the statement is usually made that the difference between the arc and the chord is an infinitesimal of *third* order; but in the present instance it is in fact of the *first* order. The same class of curves shows that even when there is no cusp or singular point the radius of curvature may vanish. It is remarkable that whenever the limit mentioned is not unity, it is at most equal to .94. For space curves the result is quite different, since the limit may then be any number, real or imaginary.[2]

The moral of all this is that if, originally, imaginaries were introduced into geometry because they made the statement of propositions, especially of algebraic geometry, *easier*, and bore out the principle of continuity, we have to pay for this nowadays by a systematic treatment of the imaginary figures in complete generality. We must look, with an enlightened view, over the entire complex domain, instead of restricting our attention, from some more or less accidental motive, to some cross section connected, more or less closely, with the original real domain. Of course there will always be justification for a purely real geometry (as instanced say by analysis situs, or the geometry of connection, including the theory of knots); but differential geometry has been guided mainly by the theory of analytic functions (power series), rather than the theory of functions of a real variable, and the tendency toward a perfect correspondence with the former theory seems all-compelling. The present period is one of transition, and that is always hard on both the writer of text-books and his students.

The author has certainly succeeded in getting into one volume most of the more important standard topics. This is shown by the chapter headings: Curves in space, General theory of surfaces, Organic curves of a surface, Lines of curvature, Geodesics, General curves on a surface and differential invariants, Comparison of surfaces, Minimal surfaces, Surfaces with plane or spherical lines of curvature and Weingarten surfaces, Deformation of surfaces, Triply-orthogonal systems of surfaces, Congruences of curves.

The treatment of each of these topics is quite elaborate, in many instances the proofs are more elegant than those usually given, and an abundant selection of problems (many

[2] See *Bull. Amer. Math. Soc.*, Vol. 20, p. 727.

of them difficult, and often containing important results, as is to be expected of a Cambridge treatise) is included.

Perhaps the most important and interesting feature of the book is the long chapter dealing with differential invariants, covariants, and parameters. The algebraic method employed is due to Forsyth himself, and was first published in a memoir in the *Philosophical Transactions*, 1903. The calculations are arranged very ingeniously, and the detailed results are certainly useful. The geometric interpretations, however, are not always clear, and sometimes they appear to be only partly geometric. The practise of calling a result geometric when it is in fact semi-geometric and semi-algebraic is unfortunately rather prevalent.

The author's terminology, in this connection, can not be recommended. He speaks of the invariants of "a single curve," when he really means a *system* of curves, simply infinite in number. His results have in fact no meaning for a single curve. It would be absurd to imply that the author's ideas are not clear—it is merely a matter of careless terminology. The distinction between a *system of curves* and a *curve* is just as great as that between a *curve* and a *point*. Of course a system is made up of an infinitude of curves, just as a curve is made up of an infinitude of points, but that is no excuse for identifying the configurations.

The long list of invariants for "two curves" refers actually to two simply infinite systems of curves, a figure usually called a *net* of curves. The author is not here discussing doubly-infinite systems. It is best to avoid the ambiguous term double system: it refers sometimes to a double infinity (that is, infinity times infinity) and sometimes to two single infinities (that is, a net).

After the discussion of "one curve" and "two curves," the rather mysterious statement is made that "we could not consider profitably more than two independent curves." As a matter of fact there are some very important (and naturally very difficult) problems connected especially with *three* systems, and, in the reviewer's opinion, the investigation will have to be extended.

Another more serious confusion of terms, and even of ideas, is prevalent in geometric literature. We refer to the distinction between a *system of curves* and a *parametered system of curves*. The latter object arises frequently in applications. For example, in a topographic map we have to deal not merely with the system of contour lines, but with the particular numbers attached to these curves indicating the heights above sea level. The same system of curves with different numbers would represent a different topography. In most discussions in geometry we are concerned merely with the system of curves; but if the attached numbers or parameters are also of significance, as they often are, the compound object should be called not a system, but a parametered system.

Even in one dimension an analogous distinction is important. A curve consists of a single infinity of points: if the points are labeled with numbers, then we have a new figure, a *parametered curve*. A straight line with a logarithmic scale is certainly different from a straight line with an ordinary uniform scale. A correct and well developed terminology is at hand in, for example, d'Ocagne's *Nomography*. This branch of mathematics was originated and developed almost entirely by engineers (mainly the French school), rather than pure mathematicians, but it is certainly time for writers on geometry to take advantage of their work.

With this terminology, it is possible to state very compactly a fundamental theorem in the theory of functions of a complex variable, as follows: Any (analytic) parametered curve can be converted into any second parametered curve by a unique direct (and a unique reverse) conformal transformation. This is true of parametered curves but not of curves: any curve can be converted into a second curve by an infinitude of conformal transformations.

The author is to be commended for not confining himself, as much as most writers do, to questions of first and second order (of

geometric infinitesimals). Third order questions have been treated in a haphazard way in the standard literature. Even in the simple case of plane curves, the average student becomes familiar only with the interpretation of the first derivative as slope (tangent line), and of the second derivative as curvature (osculating curve). As regards the third derivative, his mind is usually blank. Even the elementary books should contain the definition of *deviation,* introduced by Transon over seventy years ago.

An excellent index and table of symbols will be appreciated by the student, and make the volume serviceable for convenient reference. The press work throughout is quite perfect.

Edward Kasner
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A Catalogue of the Fishes of Japan. By David Starr Jordan, Shigeho Tanaka and John Otterbein Snyder. Journal of the College of Science, Tokyo Imperial University, Vol. XXXIII., article 1. Tokyo, 1913. 8vo. Pp. 1–497, with 396 text-figures.

Japan possesses a wonderfully rich fish fauna. This is due to several causes: first, to the fact that she consists of a chain of islands with innumerable small, sheltered bodies of water which afford great variety of depth, physical condition of sea floor, etc.,—factors highly favorably to a diversity of fish life. Secondly, to her remarkable north-and-south extent, which gives her in addition to the regular north temperate fauna, in itself unusually rich in this instance, a subtropical fauna allied to that of the Philippine Islands, in the south, and a fauna merging into a subarctic one, in the extreme north. Thirdly, her eastern coast is touched by the *Kuroshiwo,* or warm black current, which harbors many tropical forms, some of them exceedingly rare, or in fact, only known from this current.

With such remarkable conditions, it is not surprising that ichthyologists should have been attracted to the study of Japanese fishes. Many of the writers of this and the preceding generation have taken a hand in describing portions of this fauna as materials were brought from Japan, so that an extensive literature has grown up about it. And there has been at least one extensive work on this fauna—that of Temminck and Schlegel, in two superb folio volumes, one of text and one of plates, published between 1842 and 1850.

But an entirely new chapter in Japanese ichthyology was opened when, in 1900, Chancellor Jordan and Professor Snyder, of Leland Stanford University, visited Japan for the purpose of studying the fishes. As a result of the collections then made, and of others made subsequently, including one by Gilbert and Snyder in the *Albatross,* in 1906, Jordan and his associates Gilbert, Snyder, Starks, Richardson, Fowler, Herre, Seale and Thompson, have worked unremittingly on this fauna, publishing paper after paper, until a long series, numbering several score, has now appeared. They have described hundreds of new species; figured, revised, re-studied, and thrown light on many of the darker problems relating to the fishes of Japan.

Early in the course of these studies it became patent to Jordan and Snyder that it was necessary to take stock of what had already been done on the Japanese fauna. Accordingly, in 1901, they published "A preliminary check-list of the fishes of Japan." This incorporated all the data then available, including two lists published by Japanese ichthyologists. The number of species listed was 686, many, however, only doubtfully referred to Japan. And now we have a new catalogue of the fishes of Japan from the pen of Jordan, Tanaka and Snyder. An idea of the enormous wealth of the Japanese fish fauna, as well as of the great stride that has been made in its study in a little over a decade, is shown in the fact that the present catalogue lists no less than 1,236 species (including the 6 given in the Additions and Corrections, pp. 429–430), or nearly twice the number known in 1901.

The catalogue—or check-list, as it might more correctly have been termed—enumerates the families, genera and species of the fishes occurring in the waters of Japan. Under each species is given a reference to the first describer, and generally, to a reviser; together

with the geographical distribution and one or more local Japanese names. Nearly one third of the species—396, to be exact—are illustrated, the admirable figures which have appeared in the publications of Jordan and his associates being reproduced. An excellent index to genera, species and Japanese names, covering 64 pages, greatly enhances the usefulness of the work. (This index, by the way, contains a number of misspellings—for instance, of *Scapanorhynchus, Etmopterus,* etc.).

A critic might perhaps find fault with the retention of a few superseded names, such as *Mitsukurina* for *Scapanorhynchus,* when it has been fairly well established that the former is identical with the fossil sharks which have long been known under the latter name; or with the omission of certain desirable references, to show that *Zameus*—to mention but a few instances—is a synonym for *Scymnodon, Deania* a synonym for *Centrophorus, Etmopterus frontimaculatus* probably a synonym for the Mediterranean *Spinax pusillus,*[1] etc. But in answer to such criticisms it may be said that the present list was obviously intended as a mere stock-taking of all the species that have been proposed, to serve as a basis for future work on the fishes of Japan; that it was not the purpose of the authors to give complete synonymies; and that these matters will be dealt with in the revisions of the various groups now being published by Jordan and his associates in America, or in the monograph by Tanak, which is appearing in part in Japan. Altogether the catalogue is carefully compiled, and will be invaluable to all students of the fishes of Japan.

The work was seen through the press by Dr. Shigeho Tanaka, lecturer in zoology in the Imperial University of Japan, and a co-author of the present work; and to him are due the thanks of all who will profit by this volume, for the great care he has exercised in guarding against typographical errors in the text.

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[1] See C. Tate Regan, "A Synopsis of the Sharks of the Family Squalidæ," *Ann. Mag. Nat. Hist.,* 8 ser., II., 1908, pp. 39–57.

Pflanzenmikrochemie. Ein Hilfsbuch beim mikrochemischen Studium pflanzlicher Objekte von Dr. O. TUNMANN, Privatdozent an der Universitaet Bern. Ein Bd., pp. 631, mit 137 Abbildungen im Text. Verlag von Gebrueder Borntraeger, Berlin. 1913. M. 18.50.

That of the writing of books there is no end is one of the few biblical quotations which even the average freshman in college will recognize. Moreover, the graduate student in science, when sent to the library for references, is apt to wish that there might be fewer books for him to consult. Yet it is with a peculiar delight that the phytochemist witnesses the renewed literary activity in his particular field of research. Synthetic chemistry had so completely overshadowed phytochemistry for a generation and more since the days of Kekulé's structural theories, that the phytochemist is once more beginning to feel that his particular aspect of chemical research is again coming to its own. With a general treatise such as that by Haas and Hill, with staetter and Stoll on chlorophyll, and with the volume on a special method of phytochemical technique like the one before us, all within less than a twelve-month, this unusual productivity must certainly be regarded as the heyday of phytochemical literature.

The general part of Tunmann's tome is devoted to the technique of microchemical research as applied to plants and covers sixty-three pages. Of the special part sixty-six pages are devoted to inorganic chemistry. Hence the bulk of the volume is devoted to the organic microchemistry of plants.

Inasmuch as this is the first general survey of its kind since the "Botanische Mikrotechnik" by Zimmermann made its appearance in 1892, one may gladly welcome an up-to-date treatise on this subject. Even the person who is not well acquainted with the work that has been done during the past few decades in this particular field, will be struck by the innumerable references to special "Arbeiten" with which the pages abound. The pharmacist in particular will be gratified

to see to what extent the pharmacognosist and pharmaceutical chemists have contributed to make the microchemistry of plants an important branch of phytochemical investigation, pure as well as applied.

It ought to be possible in the future to supplement the macrochemical investigation of plants in a manner that should prove productive of the very best results. If the microscope, supplemented by accessories and chemical reagents, is going to enable the phytochemist of the future to extend the macroscopic examination carried out on one or several species to all members of a genus or even family with a minimum of material and possibly of time, the boundaries of plant chemistry ought to be extended farther in a decade than they have been during a century.

E. K.

THE ORIGIN OF CLIMATIC CHANGES[1]

The discussion of meteorological observations shows clearly that climates undergo variations of short duration, but such records as the presence of old lake beaches and the existence of well-marked glacial moraines, and other geological evidence distinctly point to climate changes covering long intervals of time. The evidence is not sufficient to characterize the variations as periodic, but the ice ages are sufficient to point to times when the conditions reached were extreme.

What may reasonably be assumed to be the chief established facts about such extensive changes may be summed up briefly as follows: Climatic changes were several, and probably many. Similar simultaneous changes occurred over the whole earth, or, in other words, it was warmer or colder over the whole earth simultaneously. These times of warmth or coldness were unequal in intensity and duration, and of irregular occurrence, and, lastly, they have taken place from very early, if not from the earliest geological age down to the present. Numerous theories, both probable and improbable, have been suggested from time to time to account for the origin of such world-wide changes, and while each has its advocates, perhaps only three may be said to claim attention to-day. These may be briefly stated as the eccentricity theory (Croll), depending on the eccentricity of the earth's orbit; the carbon dioxide theory (Tyndall), based on the selective absorption and variation in amount of carbon dioxide; and thirdly, the solar variation theory, on the assumption of solar changes of long duration. A new theory, which may be called "the volcanic dust and solar variation theory," has recently been put forward by Professor W. J. Humphreys,[2] under the guarded heading, "Volcanic Dust and Other Factors in the Production of Climatic Changes, and Their Possible Relation to Ice Ages."

The author carefully points out that the idea that volcanic dust may be an important factor in the production of climatic changes is not new, but "though just how it can be so apparently has not been explained, nor has the idea been specifically supported by direct observation." He remarks also that while the pioneers regarded the presence of volcanic dust in the atmosphere as an absorbent of radiation, and so lowered the earth's temperature, modern observation suggests the opposite effect, namely, the warming of the earth's surface.

In putting forward his views of the action of dust, Professor Humphreys proceeds first to indicate that the dust that is effective is that which is situated in the atmosphere in the isothermal region or stratosphere. He then enters into the question of the size of the particles and probable time of fall, and concludes that particles of the size of 1.85 microns in diameter would take from one to three years to get back to the earth if they originally had been thrown up by a volcanic eruption.

Considering next the action of the finest and therefore most persistent dust on solar radiation, he finds that the "interception of outgoing radiation is wholly negligible in com-

[1] From *Nature*.

[2] *Journal of the Franklin Institute*, August, 1913, Vol. CLXXVI., No. 2, p. 131; also *Bulletin of the Mount Weather Observatory*, August, 1913, Vol. VI., Part 1, p. 1.

parison with the interception of incoming solar radiation."

Professor Humphreys now turns his attention to the observational evidence of pyrheliometric records, such readings being functions of, among other things, both the solar atmosphere and the terrestrial atmosphere. He thus introduces a curve showing smoothed values of the annual average pyrheliometric values, and compares this with sun-spot frequency values (representing solar atmospheric changes) and number of volcanic eruptions (representing terrestrial atmospheric changes). The similarity of the last-mentioned with the pyrheliometric curve leads him to write as follows: "Hence it appears that the dust in our own atmosphere, and not the condition of the sun, is the controlling factor in determining the magnitudes and times of occurrence of great and abrupt changes of insolation intensity at the surface of the earth."

The action of the dust intercepting at times as much as one fifth of the direct solar radiation leads him to inspect earth surface temperature values to inquire whether they are below normal on such occasions. The pyrheliometric and temperature curves suggest a relationship, but, as he states, "the agreement is so far from perfect as to force the conclusion that the pyrheliograph values constitute only one factor in the determination of world temperatures." A better agreement is secured when the combined effect of insolation intensity and sun-spot influence is considered.

The author then discusses the temperature variations since 1750 as influenced by sun-spots and volcanic eruptions, and indicates that the disagreement in the curves of temperatures and sun-spots is in every important instance simultaneous with violent volcanic eruptions.

Limitations of space will not permit us to remark on his references to the action of carbon dioxide in slightly decreasing the temperature or to probable great changes in level. Enough perhaps has been said to show that Professor Humphreys, in his interesting attempt to show "that volcanic dust must have been a factor, possibly a very important one, in the production of many, perhaps all, past climatic changes . . .," has restarted a topic which will no doubt call for criticisms and discussions from many quarters.

SPECIAL ARTICLES

THE EFFECT OF COLD UPON THE LARVÆ OF TRICHINELLA SPIRALIS

IN the course of an investigation relative to *Trichinella spiralis*, it has been determined that cold has a decided destructive effect upon the encysted larvæ of this parasite. Heretofore it has been accepted as an established fact, upon the basis, however, of insufficient evidence, that low temperatures have no considerable influence upon the vitality of the larvæ of *Trichinella*. Although the results of only a single series of the writer's experiments are available at present, these results have been so definite that there can be little doubt as to the lethal action of cold upon *Trichinella* larvæ. The writer's experimental work thus far has shown that most of the parasites survive when exposed for as long as six days to a temperature ranging between 11° and 15° F. (= —11.70° to —9.4° C.). On the other hand, when exposed to a temperature in the neighborhood of 0° F. (= —17.8° C.) the larvæ of *Trichinella* quickly succumb. Only one out of over 1,000 larvæ examined has been found to survive an exposure of six days to this temperature. This was one among 275 isolated from a piece of trichinous meat which had been kept at a temperature of about 0° F. from September 27 to 30, allowed to thaw, and then again kept at the same low temperature, October 1 to 4, a total of six days' exposure. None was found alive among 498 larvæ from a piece of trichinous meat kept at about 0° F. September 27 to 30, allowed to thaw, then exposed again to the same low temperature October 1 to 3, and thus exposed five days in all, nor was any found alive among 233 larvæ from a piece of trichinous meat kept continuously at about 0° F. for five days. Out of 301 larvæ from trichinous meat kept at about 0° F. for three days only 5 showed signs of life. 225 out of 366 larvæ exposed for two days to a

temperature of about 0° F. were dead, and many of the remaining 141 showed only faint signs of life.

Results similar to the above were obtained from tests of trichinosed meat on guinea-pigs. Guinea-pigs fed with infested meat after its exposure to a temperature of about 0° F. for two, three, six and seven days, respectively, showed no trichinæ when killed and examined three weeks after feeding. A guinea-pig fed with meat from the same source which had been kept at a temperature of 11° to 15° F. for six days showed trichinæ when killed and examined three weeks after feeding.

It is evident that the results of these experiments, if confirmed by further investigation, are likely to be of great practical importance. Trichinosis in man is a very painful, frequently fatal, disease, and moreover it is comparatively common. Roughly estimated there have been recorded in the medical literature of this country about 1,200 cases of trichinosis, of which about 200 resulted in death. These figures undoubtedly include only a fraction of the cases which actually occur. Many cases of trichinosis recognized as such are not reported, and there is good reason to believe that the vast majority of cases are unrecognized, commonly passing as rheumatism, atypical typhoid fever, or as some other disease of uncertain nature. Some years ago Williams at Buffalo reported that he had found the parasite in 27 out of 505 cadavers examined for its presence, death in no instance having resulted from trichinosis. If Williams's findings be assumed to be statistically adequate, it may be concluded that five persons out of every 100 among the population typified by the 505 cadavers examined by him suffered from trichinosis at some time in their lives and recovered, in addition to which an indefinite number died of the disease. An extensive examination of cadavers throughout the United States would be required before general conclusions as to the prevalence of the parasite could be reached, but the numerous reported cases and Williams's figures are sufficient to prove that *Trichinella spiralis* is of common occurrence in man in this country. The prevalence of the parasite in man of course depends upon its prevalence in hogs and the extent to which uncooked pork is used as food. The microscopic inspection of over 8,000,000 hogs in this country during a period of nine years showed that 1.41 per cent. were infested with living trichinæ, in addition to which there were 1.16 per cent. containing trichina-like bodies or disintegrating trichinæ, or a total of 2.57 per cent. The custom of eating raw pork is not unusual among the population of the United States as evidenced by the large quantities of various pork products intended to be eaten raw that are prepared by meat-packing establishments. Incidentally it may be noted that the consumption of such products seems to be increasing from year to year. In view of the frequent occurrence of trichinæ in hogs and the not altogether rare practise of eating raw pork it is not surprising that trichinosis should be a rather common disease in the United States. Inasmuch as warnings against the eating of raw pork seem to have little effect in discouraging this dangerous custom, certain countries in Europe have tried at great expense and not altogether successfully to guard the consumer by means of a system of microscopic inspection.

In this country microscopic inspection of all the hogs slaughtered under Federal supervision would require an expenditure of probably not less than $5,000,000 per year over and above the sum already expended for federal meat inspection. Apart from other difficulties and objections of various sorts, the matter of expense alone is a serious difficulty in the way of a general trichina inspection, and as yet the federal government has not attempted such an inspection. In recent years, however, there has been some consideration of the question of a partial trichina inspection; that is, a microscopic inspection of those hogs slaughtered under federal supervision which are intended to be used in the manufacture of pork products of kinds customarily eaten raw. Such an inspection though it would by no means remove the danger, because even the best inspection is essentially imperfect, would greatly reduce the risk involved in the eating

of raw pork products, though, perhaps, on the other hand, it would tend to encourage the custom of eating raw pork among those persons who knew of the existence of a trichina inspection and of its purpose, and thus the good the inspection did in one way would be largely offset by the evil it did in another. The protection afforded by such an inspection would of course apply only to those pork products prepared under federal supervision and would not extend to products prepared in local establishments, or in private homes, even though the pork used came from animals slaughtered in inspected establishments, inasmuch as the special inspection for trichinæ would be given only to those hogs which were expressly intended to be used in the preparation of products of kinds customarily eaten raw. Nor would such an inspection afford any protection from the danger of contracting trichinosis through imperfectly cooked pork, as hogs not intended to be manufactured into products customarily eaten raw would not be inspected for trichinæ. The partial inspection in question, however, would cover the class of pork which seems particularly likely to be the most fertile source of trichinosis in so far as meats originating from establishments under federal inspection are concerned, and the consumer of raw pork products would thus be protected in large measure so long as he limited himself to those products specially labeled as inspected for trichinæ.

The results of the experiments recorded in this article naturally suggest the possibility of substituting refrigeration for microscopic inspection as a prophylactic measure. It is perhaps rather venturesome to express an opinion at the present time as to the extent to which refrigeration might be used practically as a preventive of trichinosis, but, if it be granted that it is desirable to institute measures which will serve to protect the consumer of raw pork products, leaving out of consideration the question of a general microscopic inspection of all hogs slaughtered, it seems to the writer, in view of the defects inherent in microscopic inspection even at its best, that refrigeration (provided the data at present in hand are confirmed by further investigation) promises to afford a means of preventing trichinosis of far greater certainty, easier to apply, and less expensive than any method of trichina inspection yet devised. Instead of a microscopic inspection of the hogs from which raw pork products were to be prepared there would be required simply the refrigeration of the pork at a certain temperature for a certain length of time. It is possible, considering that the refrigeration of foods is becoming more and more general, keeping pace with the development of improved and more economical methods, that sooner or later the general refrigeration of pork, without reference to whether it is to be eaten raw or cooked, may become desirable and feasible as a prophylactic measure against trichinosis. For the present, however, it is probable that the use of refrigeration for this purpose is likely to have only a more limited application such as that which has been suggested, leaving for future development its possible further extension, all of which is of course contingent primarily upon the confirmation of the results of the experimental work recorded in this paper, and secondarily upon various other things, such as the effects of refrigeration upon the meat and the expense involved in the artificial production of cold.

Further investigation of this interesting question of the effect of cold upon trichinæ is in progress, and it is hoped that conclusive data as to the exact temperatures and time required to render trichinous meat innocuous will be available at an early date.

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BUREAU OF ANIMAL INDUSTRY,
U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.

November 22, 1913

THE AMERICAN PHYSIOLOGICAL SOCIETY

THE 26th annual meeting of the American Physiological Society was held at the University of Pennsylvania and at the Jefferson Medical School, Philadelphia, December 28–31, 1913. One hundred and eighteen of the members of the society were present at the meeting. This, I think, was

the largest attendance in the history of the society. This large attendance was due, in part, to the fact that the societies representing the biochemists, the pharmacologists, the experimental pathologists, the anatomists, the zoologists and the naturalists met in Philadelphia at the same time. This is a most excellent plan, and should be made a fixed policy of the biological societies. The members of all the biological societies had joint dinners and smokers the three evenings of the meeting.

Two of the scientific sessions of the Physiological Society were joint meetings with the Biochemical and the Pharmacological societies. The scientific program was as usual a lengthy one and comprised a number of papers of unusual importance. The number and general high grade of the demonstrations was also a feature of the meeting. The following is a list of the scientific communications:

"Phlorhizin Glycosuria before and after Thyroidectomy," by Graham Lusk.

"Studies in Diabetes: (1) The Effect of Different Compounds on Glycogenesis; (2) The Mechanism of Antiketogenesis," by A. I. Ringer and E. M. Fraenkel.

"Some Problems of Growth: (*a*) The Capacity to Grow; (*b*) The Rôle of Amino Acids in Growth," by L. B. Mendel and T. B. Osborne.

"Further Studies in the Comparative Biochemistry of Purine Metabolism," by Andrew Hunter.

"Changes in Fats during Absorption," by W. R. Bloor.

"Immunization Against the Anti-coagulating Effect of Leech Extract," by Leo Loeb.

"Anaphylaxis in the Cat and Opossum," by C. W. Edmunds.

"Vividiffusion: Report on Preliminary Results," by J. J. Abel, L. S. Rowntree and B. B. Turner.

"A Method of Dialyzing Normal Circulating Blood and Some of Its Applications," by C. L. V. Hess and H. McGuigan.

"A Biological Test for Iodin in the Blood," by A. Woelfel and A. L. Tatum.

"Further Studies of the Excretion of Acids," by L. G. Henderson and W. W. Palmer.

"Studies on Blood Plates," by T. F. Zucker.

"The Condition of the Blood in Hemophilia," by W. H. Howell.

"Some Physiological Factors Affecting the Coagulation Time of Blood," by W. B. Cannon and W. L. Mendenhall.

"The Action of Epinephrin on the Heart," by J. A. E. Eyster.

"Two Types of Reflex Fall of Blood Pressure," by P. G. Stiles and E. G. Martin.

"Dicrotism and the Brachial Flow Pulse (with lantern demonstrations)," by A. W. Hewlett.

"The Periodic Cardio-vascular and Temperature Variations in Women," by Jessie L. King.

"Acceleration of the Heart in Exercise," by H. S. Gasser and W. J. Meek.

"On the Constancy of Blood Pressure and Vasomotor Reactions in the Anesthetized Dog," by R. G. Hoskins and H. Wheelon.

"The Relative Systolic Discharge of the Left and the Right Ventricles," by A. L. Prince.

"The Effect of Vagal Stimulation on the Location of the Pacemaker of the Mammalian Heart," by W. J. Meek and J. A. E. Eyster.

"The Effect of Pulsation on Filtration," by R. A. Gesell.

"The Action of Pilocarpin on the Cerebrospinal Fluid," by F. C. Becht.

"The Osmotic Properties of Clam's Muscle," by E. B. Meigs.

(*a*) "Sources of Surface Tension in Striated Muscle," (*b*) "Maximum Surface Tension in Striated Muscle," by W. N. Berg.

"Some Characteristics of Mammalian Muscle," by F. S. Lee.

"Some Results Obtained by the Use of Quantitative Faradic Stimuli in Physiological Investigation," by E. G. Martin.

"Faradic Stimuli: A Physical and Physiological Study," by J. Erlanger and W. E. Garrey.

(*a*) "The Metabolic Gradient in the Nerve Fiber," (*b*) "The Action of Anesthetics on the CO_2 Production in the Nerve Fiber," by S. Tashiro.

"Proof that the Propagation of the Nervous Impulse Obeys the Laws of Propagation of Electricity along Conductors with Distributed Capacity," by A. C. Crehore and H. B. Williams.

"Saline Perfusion of the Spinal Centers in Frogs: The Effect of Calcium and Potassium Chloride," by R. D. Hooker and S. O. Reese.

"Variations in the Reflex Responses through Medullary Centers," by H. C. Jackson and E. M. Ewing.

"Evidences in the Cerebral Cortex of Mental Equipment and Intellectual Development," by E. L. Mellus.

"The Influence of Surroundings on Foveal Vision," by P. W. Cobb.

"The Effect of Strychnin on Reflex Thresholds," by E. L. Porter.

"The Influence of the Vagi on Renal Secretion," by R. G. Pearce.

"Stimulation of the Semi-circular Canals," by F. H. Pike.

"Demonstration of Vividiffusion," by J. J. Abel, L. G. Rowntree and B. B. Turner.

"The Determination of Blood Sugar," by P. A. Shaffer.

"Intestinal Peristalsis in *Homarus*," by F. R. Miller.

"Methods for Studying the Pharmacology of the Circulation," by C. Brooks.

"The Contour of the Intraventricular and the Pulmonary Arterial Pressure Curves by two new Optically Recording Manometers," by C. J. Wiggers.

"Some Time-saving Laboratory Methods," by C. C. Guthrie.

"A Graphic Method for Recording the Coagulation of Blood," by W. B. Cannon and W. L. Mendenhall.

"Some Mutual Relations of Oxalates, Salts of Magnesium and Calcium: Their Concurrent and Antagonistic Actions," by F. L. Gates and S. J. Meltzer.

"A Method of Obtaining Successive Contrast of the Sensations of Hunger and Appetite," by A. J. Carlson.

"Further Observations on the Pyramidal Tracts of the Raccoon and Porcupine," by S. Simpson.

"A New Apparatus for Demonstration of the Dioptrics of the Eye and the Principles of Ophthalmoscopy and Retinoscopy," by A. Woelfel.

"Simple Experiments on Respiration for the Use of Students," by Y. Henderson.

"Convenient Modification for Venous Pressure Determinations in Man," by R. D. Hooker.

"Device for Interrupting a Continuous Blast of Air. Designed Especially for Artificial Respiration," by R. A. Gesell and J. Erlanger.

"A Simple Liver Plethysmograph," by C. W. Edmonds.

"An Artificial Circulation Apparatus for Students," by W. P. Lombard.

"A Simplified and Inexpensive Oxadase Apparatus," by H. H. Bunzel.

"An Improved Form of Apparatus for Perfusion of the Excised Mammalian Heart," by M. Dresbach.

"Sugar Consumption in Eviscerated Animals," by J. J. R. Macleod and R. G. Pearce.

"On the Rapid Disappearance from the Blood of Large Quantities of Dextrose Injected Intravenously," by I. S. Kleiner and S. J. Meltzer.

"Further Observations on the Metabolism of Depancreatinized Dogs," by J. R. Murlin.

"Transfusion of Blood in Severe Diabetes Mellitus," by R. T. Woodyatt and B. O. Raulston.

"The Cause of Diabetic Polyphagia," by A. B. Luckhardt.

"Preliminary Report on Work with a Respiration Calorimeter in Bellevue Hospital," by E. F. DuBois.

"The Rôle of Nascent Oxygen in Protecting the Body from Self-digestion," by W. E. Burge.

"The Effect of Castration on the Hypophysis in the Rabbit," by A. E. Livingston.

"The Secretion of Gastric Juice during Parathyroid Tetany," by R. W. Keeton.

"The Brain-Adrenal-Thyroid-Liver-Pancreas Syndrome (Kinetic System)," by G. W. Crile.

"The Variations in the Hunger Contractions of the Empty Stomach with Age," by T. L. Patterson.

"The Control of the Hunger Mechanism," by A. J. Carlson.

The following persons were elected to membership in the society: E. F. DuBois, Cornell University Medical School; O. C. Glaser, University of Michigan; E. M. Ewing, Bellevue Medical School; S. Tashiro, University of Chicago; A. L. Tatum, University of Chicago; H. Laurens, Yale University; J. E. Sweet, University of Pennsylvania; E. Lodholz, University of Pennsylvania; G. Fahr, Johns Hopkins Medical School; J. H. King, Johns Hopkins Medical School; R. E. Gesell, Washington University, St. Louis; O. O. Stoland, University of South Dakota; E. L. Porter, Harvard Medical School; P. E. Howe, Columbia University; H. A. Mattill, University of Utah; Mabel P. FitzGerald, New York City.

This makes the total membership of the society 210.

The most important matter in the way of business was the ratification of the work of the conference committee appointed at the Cleveland meeting establishing the Federation of American Societies for Experimental Biology. One of the aims of this federation is the coordination of the scientific work of the annual meetings, a successful beginning of which was made this year. But a great deal of the credit for this successful beginning is due to the splendid facilities offered by the Philadelphia institutions, and the careful planning and hard work of the local committee.

The Washington University presented an invitation to meet in St. Louis next year. The society voted in favor of meeting in St. Louis, but the final decision is left with the executive committee of the federation.

The editorial committee (Drs. Porter, Carlson, Erlanger, Howell, Lee, Lusk, Macallum) was instructed by the society to report at the next annual meeting on the relation of the *American Journal of Physiology* to the American Physiological Society and to propose measures to improve the facilities for publication on the part of American physiologists.

Officers for the year 1914.—President, W. B. Cannon; *Secretary,* A. J. Carlson; *Treasurer,* J. Erlanger; *Members of the Council,* F. S. Lee, S. J. Meltzer.

A. J. CARLSON,
Secretary

UNIVERSITY OF CHICAGO,
January 10, 1914

THE AMERICAN PHYTOPATHOLOGICAL SOCIETY

THE society met in affiliation with the American Association for the Advancement of Science in the state capitol at Atlanta, Ga., December 30, 1913, to January 2, 1914.

The following officers were elected:

President, Dr. Haven Metcalf, U. S. Department of Agriculture, Washington, D. C.

Vice-president, Dr. Frank D. Kern, Pennsylvania State Agricultural Experiment Station, State College, Pa.

Member of Council, Dr. H. R. Fulton, North Carolina Agricultural Experiment Station, West Raleigh, N. C.

Chief editors of *Phytopathology* were elected as follows: Dr. L. R. Jones, for one year; Dr. C. L.

Shear, for two years; Dr. R. A. Harper, for three years.

The following associate editors were elected for three years: Dr. F. D. Heald, Dr. Mel T. Cook, Dr. B. M. Duggar, Professor F. C. Stewart.

Dr. Donald Reddick was reelected business manager of *Phytopathology*.

About fifty members were in attendance.

The society decided to hold its next meeting in conjunction with the American Association for the Advancement of Science at Philadelphia, Pa.

The following program was presented by abstract, the abstracts having been published and distributed before the meeting. This plan was undertaken in an attempt to devise some means of securing time to discuss the numerous papers which are offered for presentation. These abstracts were read by the authors and formed the basis of questions and discussions. The plan was generally pronounced a great success, as it resulted in rather a full discussion of almost every paper presented.

"Fruit Rots of Egg Plant," by Frederick A. Wolf.

"Formaldehyde Gas Injury to Potato Tubers," by F. C. Stewart and W. O. Gloyer.

"Stem Rot and Leaf Spot of *Clematis*," by W. O. Gloyer.

"A Preliminary Note on the Cause of 'Pecky' Cypress," by W. H. Long.

"Inspection and Certification of Potato Seed Stock," by W. A. Orton.

"The Fungus Genus *Verticillium* in Its Relation to Plant Diseases," by W. A. Orton.

"A Phoma Rot of Irish Potatoes," by I. E. Melhus.

"A New Rust of Economic Importance Occurring on Pomaceous Hosts," by H. S. Jackson.

"Notes on the White Pine Blister Rust," by Perley Spaulding.

"Relation of the Mosaic of the Pepper and the Filiform Leaf of the Tomato to the Mosaic of the Tobacco," by Carl A. Schwarze.

"*Cladosporium* Disease of *Ampelopsis tricuspidatum*," by Mel. T. Cook and Guy West Wilson.

"The Use of Sulphur Lime Wash as a Remedy for Apple Scab," by R. Kent Beattie.

"Cotton Anthracnose. Some Field Problems and Some Field Experiments," by H. R. Fulton, J. R. Winston and R. O. Cromwell.

"Can *Cronartium ribicola* Overwinter on the Currant," by F. C. Stewart and W. H. Rankin.

"An Improved Method of Making Separation Cultures," by A. F. Blakeslee.

"Collar-blight of Apple Trees in Pennsylvania," by C. R. Orton and J. F. Adams.

"Fusaria of Potatoes," by C. D. Sherbakoff.

"Some Points in the Life History of *Phytophthora* on Ginseng," by J. Rosenbaum.

"Comparative Dusting and Spraying Experiments," by F. M. Blodgett.

"*Sphæropsis* Canker of *Quercus prinus*," by W. H. Rankin.

"Biological Strains of *Sphæropsis malorum*," by L. R. Hesler.

"Decay of Celery in Storage," by D. Reddick.

"A Destructive Nematode Introduced into the United States," by L. P. Byars.

"Experiments on the Control of Certain Barley Diseases," by A. G. Johnson.

"Some Observations and Experiments on the Black-leg of Cabbage," by M. P. Henderson. (With lantern.)

"The Non-validity of the Genus *Lasiodiplodia*," by J. J. Taubenhaus.

"Progress in Developing Disease Resistant Cabbage," by L. R. Jones. (With lantern.)

"Disease Resistance in Tobacco to Root Rot," by James Johnson. (With lantern.)

"The Life History of *Sphæropsis malorum* Berk.," by C. L. Shear. (With lantern.)

"Blossom-end Rot of Tomato," by Charles Brooks. (With lantern.)

"A Little-known Disease of Chestnut and Oak Trees," by F. D. Heald. (With lantern.)

"A Preliminary Report on Fruit Infection of the Peach by Means of Inoculation with *Cladosporium carpophilum* Thum. from Peach Twigs," by G. W. Keitt. (With lantern.)

"Bibliographical Citations," by C. L. Shear.

"Some Recent Studies on New or Little-known Diseases of the Sweet Potato," by J. J. Taubenhaus. (With lantern.)

"Wind Dissemination of Ascospores of the Chestnut Blight Fungus," by F. D. Heald, M. W. Gardner and R. A. Studhalter. (With lantern.)

"Longevity of Pycnospores of the Chestnut Blight Fungus in Soil," by M. W. Gardner.

"The Relation of Temperature to the Expulsion of Ascospores of *Endothia parasitica*," by R. C. Walton.

"Insects as Carriers of the Chestnut Blight Fungus," by R. A. Studhalter.

"Perithecia in Cultures of *Venturia inequalis*," by Fred R. Jones.

"Gum Formation in *Citrus* as Induced by Chemicals," by B. F. Floyd.

"A Study of the Annual Recurrence of *Phytophthora infestans*," by I. E. Melhus.

"Fungous Gummosis of *Citrus* in California," by H. S. Fawcett.

C. L. SHEAR,
Secretary-Treasurer

THE PALEONTOLOGICAL SOCIETY

THE fifth annual meeting of the Paleontological Society was held at Princeton, N. J., on Wednesday, December 31, 1913, and Thursday, January 1, 1914, in affiliation with the Geological Society of America. The meeting this year included a general session in which selected papers of interest to all members of the society were read, and special sessions dealing with vertebrate and invertebrate paleontology and paleobotany. Notable features of the meeting were first, the president's address by Dr. Charles D. Walcott on the Cambrian of western North America, and second a conference on the close of the Cretaceous and opening of Eocene time. In the latter the geological and paleontological evidence was presented by Messrs. F. H. Knowlton and T. W. Stanton, and recent discoveries in regard to late Cretaceous and early Eocene life were reported especially as a result of the American Museum expeditions under Messrs. Barnum Brown and Walter Granger.

A new Ungulate of very distinctive South American type was recorded by Dr. Matthew as additional evidence of affinity between North and South America in Lower Eocene times. The line of ancestry of the uintatheres was recorded as traced into Basal or Paleocene times. A new fauna is described between the Puerco-Torrejon and Wasatch, to be known as the Clark Fork. Still more striking was the record of Mr. J. W. Gidley, of the U. S. National Museum, of the occurrence of a true eland *Taurotragus* in the Pleistocene cave of western Maryland. This discovery confirms the statement of J. C. Merriam of the occurrence of African antelopes in Virgin Valley, northern Nevada and links North America very closely to Asia in Pliocene times. Accompanying the eland was a peculiar species of African dog.

R. S. BASSLER,
Secretary

SOCIETIES AND ACADEMIES

THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 516th meeting of the society was held on November 15, 1913, Vice-president Paul Bartsch in the chair and 35 persons present.

F. V. Coville presented a communication on "The Physiology of the Blueberry." His remarks were based on wide experience in greenhouse and outdoor culture of this plant. Three conditions are essential to its successful propagation: first, an acid soil; second, the presence of the micorrhizal fungus to enable the plant to obtain nitrogen, and third, the stimulating effect of cold on the twigs while they are dormant. The last is a condition of vital importance, associated as it is with the transformation of starch into sugar. As a result of this series of experiments, the commercial propagation of the blueberry is now possible. Very large berries have been developed, some of them from $\frac{1}{2}$ inch to $\frac{7}{8}$ inch in diameter. The various means of cultivation were explained and illustrated by means of numerous lantern slides.

W. C. Kendall, the second speaker announced on the program, was absent, and the chairman asked Dr. Leon J. Cole, of the University of Wisconsin, to address the society. He responded by giving an account of his experiments in breeding pigeons for the study of color inheritance.

Owing to lateness, the communication by Barton W. Evermann was postponed.

THE 517th meeting of the society was held on November 29, 1913, President E. W. Nelson in the chair and 63 persons present.

The meeting was devoted to a discussion of Parallel Development. A. D. Hopkins read a paper on "Parallelism in Morphological Characters and Physiological Characteristics in Scolytoid Beetles." He had made a special study of these beetles and his ideas of parallelism in nature were largely founded on evidence they have furnished. He defined the subject as follows:

"Parallelism in morphological characters and physiological characteristics in Scolytoid beetles relates to the occurrence of the same or similar elements of structure or the same kind of activity in two or more species, genera, subfamilies or families. Parallel species, genera and larger groups are those in which structure or habit is in many respects alike. Such species or groups may be closely allied or more or less widely separated. Universal parallelism relates to repeated or multiple origin, development and evolution of the same or similar inorganic or organic form or activity.

"This tendency towards parallel development appears to be in accordance with a fundamental principle or law of *parallelism in evolution*, under which the origin and evolution of the same form or activity, under the same or similar physical in-

fluences, has been repeated many times; or, in other words, that under similar environments, needs, and requirements in nature, independent development and evolution from a common base may produce repeatedly the same or similar morphological and physiological results."

Numerous examples were given and illustrated on the board, of characters of structures and characteristics of habit which were paralleled over and over again in connected and disconnected genera, subfamilies and families. He also illustrated characters and characteristics which were paralleled in all of the species of a single genus and in connected genera, groups, subfamilies and families, and said further:

"Thus we see that parallel modification in morphological and physiological elements is an important factor to be considered in taxonomy. It is evident from a comparative study of the various systems of classification that the failure of taxonomists to fully realize its importance has led to many erroneous conclusions and much confusion.

"In conclusion, it seems to me that we have two fundamental questions to be answered in regard to the origin, evolution and classification of organism:

"1. Are the taxonomic characters and characteristics of the species, genus, family, order, class and kingdom, *the result of phylogenetic descent from a single ancestral nucleus, through natural selection and the inheritance of selected characters?* or

"2. Are they *the result of phylogenetic descent from many nuclei through natural selection and natural parallelism?*

"I am inclined to the belief that an affirmative answer to the second question would be more nearly in accordance with natural law.

"Phylogenetic descent from a single source is represented by a single genealogical tree.

"Parallelism from different sources may be represented by a forest of genealogical trees, the different elements of which are as near alike as the branches, leaves, flowers and fruit of a forest of oak trees."

President Nelson exhibited a series of mammals similar in outward appearance but widely different in structure and classification, showing the parallelism of shape and color.

H. C. Oberholser discussed parallel development as illustrated in birds. He showed a large series of specimens in which resemblances in form and color were very striking.

J. W. Gidley pointed out the difference between parallel and convergent development.

Messrs. Lyon, Hay, Baker, Bartsch and Gill took further part in the discussion.

In closing, Dr. Hopkins remarked on the large number and most striking examples of parallelism in the mammals and birds which had been exhibited by Messrs. Nelson and Oberholser, stating that the discussion based on them had related to only one phase of the principle, namely, disconnected or homomorphic parallelism which was very different from related or homologous parallelism. One is parallelism in structure, color, habit, etc., which is not correlated with evidences of natural affinity, but is repeated in more or less widely separated groups and species, while the other is parallelism of structure, color, habit, etc., which is correlated with evidences of natural affinity and is repeated in the same species or in connected genera or larger groups.

We must not overlook the fact that there are many different kinds of parallel modifications in evolution, some applying to the universe in the parallel development of systems, suns and planets, others to chemical elements and compounds, others to psychological phenomena, etc. Indeed, its manifestation in all branches of human knowledge is so evident that it may be considered as representing a science.

THE 34th annual meeting and 518th regular meeting of the society was held on December 13, 1913, President E. W. Nelson in the chair and 28 persons present.

The annual reports of the officers were read.

The election of officers for the year 1914 resulted as follows:

President: Paul Bartsch.

Vice-presidents: J. N. Rose, A. D. Hopkins, W. P. Hay, Mary J. Rathbun.

Recording Secretary: D. E. Lantz.

Corresponding Secretary: W. L. McAtee.

Treasurer: Wells W. Cooke.

Members of Council: William Palmer, Hugh M. Smith, Vernon Bailey, Marcus W. Lyon, Jr., N. Hollister.

The president, Paul Bartsch, was selected to represent the society as vice-president in the Washington Academy of Sciences.

President Bartsch appointed the following committee on publication: N. Hollister, W. L. McAtee, Wells W. Cooke.

D. E. LANTZ,
Recording Secretary